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Abstracts. Initialled abstracts in the present number are by W. Filewicz, Sinoleka Experiment, Station, Siedlce, Poland, N. B. Bagenal, W. A. Bane, and A. B. Beakbane.

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Horticultural Abstracts

Vol. VI.

March, 1936

No. 1

HORTICULTURE—MISCELLANEOUS.

1. GREGORY, F. G. 612.014.44 : 581.145.1
The effect of length of day on the flowering of plants.*
Sci. Hort., 1936, 4 : 143-54, bibl. 10.

This paper is a summary of the knowledge to date on the phenomenon of photoperiodism, i.e. the fact that plants can apparently be divided into two groups, *short day plants* which flower only with a short daily exposure to light (less than 12 hours) and *long day plants* which flower only with long daily exposures (more than 12 hours). Examples of short day plants are many sub-tropical cereals, soybean, and, to quote a familiar garden annual, *Cosmos bipinnatus*. Experiments with this latter plant have shown that when submitted to short day periods it will flower when 30 inches high, but under long day periods it may reach the height of 15 feet before flowering. [Thus the (to gardeners) irritating habit of this half hardy Mexican annual of often delaying its flowering under the long English summer days almost until the autumn frosts arrive is explained. In its native land days and nights are of more equal length.—ED.] Soybeans due to flower in September under ordinary conditions were brought into flower on June 16th under a daylight reduced to 5 hours. On returning to long days on June 20th seed ripened and the plants appeared about to die. However, new shoots soon appeared at the base and a second crop of flowers appeared at exactly the same moment as on the controls which had been exposed throughout to full summer daylight and were now being influenced to flower by the shortening day length. Examples of long day plants are the temperate spring cereals, clover, runner beans and garden peas. Shortening of the day prevents these from flowering. There are many others. Tuber formation is also affected by length of day, e.g. the potato produces tubers earlier and more freely under short day treatment. Autumn leaf fall has been entirely prevented in the normally deciduous tulip tree (*Liriodendron tulipifera*) by additional illumination from sunset to midnight. In millet, a short day plant, which often has to be grown under long day conditions and so flowers late, the period before flowering was shortened from 51 to 26 days by the effect of only 6 short days given shortly after germination. The photoperiodic effect can also be localized on the plant, i.e. treated branches can be made to respond while untreated branches on the same plant remain normal. In giving theoretical consideration to the problem, the author shows that the effect of photoperiodism is probably not so much to influence the conditions leading to flower formation as to inhibit or postpone flowering after the flower primordia have been laid down. He does not agree with the view that rapid vegetative growth will totally suppress the laying down of flower primordia, and suggests (quoting recent research) that the carbohydrate : nitrogen balance is determined by flower formation and not vice versa. He considers that such simple hypotheses as the antagonism of the vegetative and reproductive tendencies or the variation in chemical components are inadequate to explain either flower formation or photoperiodic effect. Evidence as to whether a light or a dark period or both condition flower formation is, the author remarks, simply not available except in the case of cereals. Here it can be shown that in both winter rye and millet short days accelerate the rate of development of the growing point, and that in millet differentiation of the primordia

* See also 52.

is five times as rapid under short as under long day treatment. After this preparatory period of vegetative development flowering is initiated and occurs equally in long or short days. Thus it is in these cereals merely a case of the rate of development of particular organ primordia being favoured by short illumination or long darkness. In the case of long day cereals primordium initiation is little affected by length of day, but it is the later stages of flower production and the elongation of the flowering stem which are affected by long days. The whole subject is extremely complex and will tax the resources of morphological, biochemical and horticultural sciences to solve.

2. PURVIS, O. N.

581.143.26.03 : 581.145.1

Vernalization : a new method of hastening flowering.

Sci. Hort., 1936, 4 : 155-64, bibl. 16.

The method known in England as vernalization was devised in Russia to hasten the onset of flowering in regions with a short growing season. This is effected by treatment of the germinating seed at a very early stage. The seed can afterwards be used without damage in the seed drills. For the treatment of long day temperate cereals the seed must be no longer dormant and must be kept in the dark for a certain time at a low temperature. To start germination a total moisture content of 50% of the absolute dry weight of the seed is necessary. This means the addition of 30.5% of water by weight to the seed. The seed is usually spread on a cement floor, and the water given in 3 separate applications, the seed being well stirred with shovels. In 24 hours at room temperature the seed should be swollen and the radicles emerging. Winter varieties are then chilled to approximately 34° F. for a considerable time, say 45 days in some cases, while spring varieties require a shorter exposure to 42° F. only, for perhaps 10-15 days. Short day plants (see abstract No. 1), such as millet, coming from the sub-tropics and maturing with difficulty in temperate regions are treated differently, and as a result millet can be changed from a short day plant to one which will flower even under continuous light. The treatment here is to germinate the seed in darkness at a temperature of 70° F.-85° F. while preventing growth by limiting the moisture. A table is given showing temperatures and moistures for 4 different short day crops ; e.g. maize, 30 c.c. of water added to 100 grams of seed, germination temperature 70°-85° F., period of treatment 10-15 days. The moisture is applied and the seed frequently stirred at a temperature of 50°-60° F. and when all is absorbed and the seed coats are cracking the seeds are placed in the high temperature for the requisite number of days. Frequent failures reported with short day plant vernalization may be due to the narrow range of moisture permissible, since excess or deficiency will cause over-germination or drying-up respectively. Experiments with a balanced salt mixture, which it is hoped will prevent growth without damaging the seeds, are being undertaken in Odessa. In its practical application vernalization has made the regular cropping of cereals possible in large districts of Northern Russia where hitherto cropping had always failed. Other examples of the use of vernalization in plant breeding and other horticultural fields are given. The theoretical aspects of the phenomenon are discussed. The author asks three questions to which at the moment she says, no answer that is fully satisfactory is forthcoming, at any rate from published work. (1) Is darkness or temperature or delay the factor necessary to promote flowering? (2) Why is the effect not immediately apparent but delayed during a period of vegetative growth? (3) In what way does the vernalized seedling differ from one which has not been so treated? It has different potentialities, but is there any way in which its condition can be recognized immediately?

3. GOURLEY, J. H., AND HAVIS, L.

581.1/4

Plant anatomy in agricultural research.

Gartenbauwiss., 1935, 9 : 451-9, bibl. 5.

The authors show that a real appreciation of the results of the chemical and physical stimulation of plants by chemicals (fertilizers) or pathological agents can only be gained by a close study of the anatomy and morphology of the plants concerned.

4. COOPER, W. C. 631.535 : 581.144.2
Hormones in relation to root formation on stem cuttings.
Plant Physiol., 1935, 10 : 789-94, bibl. 2.

The application of the root-forming hormone, B-indolyl-acetic acid, mixed at a rate of 1 part to 2,000 parts of pure lanolin, to cuttings of Eureka lemon of mature wood, about 5" long, and carrying 4-5 leaves, caused both greatly increased and considerably accelerated rooting as compared with controls. The hormone also caused root formation on cuttings without leaves compared with no roots produced by the controls. Where cuttings were completely girdled above the sand and the hormone applied above the girdle, rooting occurred in only two cases in which callus had bridged the girdle. This indicates that the hormone is transported in the phloem. Confirmatory results were obtained with cuttings of *Lantana*, fig, *Acalypha* and *Tradescantia*. The results with lemons are considered so encouraging that experiments are now in progress with oranges and grapefruit, which are known to be more difficult subjects to root.

5. TINCKER, M. A. H. 577.17
Experiments with follicular and other hormones and plant growth.
Ann. appl. Biol., 1935, 22 : 619-29, bibl. 18.

The acceleration of flowering claimed elsewhere to be produced by small quantities of follicular hormones suggests possibilities of considerable horticultural interest. With this in mind the experiments described here were designed to test the influence of certain ovarian hormones upon the development of several types of flowering plants. Ketohydroxoestrin and theelol were presented in small quantities in the form of solutions given to the roots, by injection, and applied to cut surfaces. In no case, however, was growth or flowering accelerated, but it must be understood that it has not been proved that the substances presented, even when injected, were actually taken up by the plant tissues. It is sufficient to say that ovarian hormones do not appear to influence the rate of growth very readily. Negative results are reported from a preliminary test, in which an extract from yeast containing auxin was taken up in a weak alkaline solution and presented to the roots of hyacinths. It appears that the auxin or its sodium derivative was not absorbed by the plant, and other investigators are warned against wasting valuable extracts in weak alkaline solutions. In a further experiment, designed for another purpose, it was found that auxin accelerated bacterial growth, which may possibly confirm the results of Knight and Fildes. The organism so stimulated was found to be apparently an undescribed species. It has been given the name *Bacterium auxinophilum* by Dr. S. E. Jacobs, who contributes a description of it in the form of an appendix.

6. WIDDOWSON, E. M., AND McCANCE, R. A. 631.556.1 : 581.192
The available carbohydrate of fruits. Determination of glucose, fructose, sucrose and starch.
Biochem. J., 1935, 29 : 151-6, bibl. 8.

The glucose, fructose, sucrose and starch in 41 varieties of fruit have been determined. Sucrose was estimated by the increase in reducing power after inversion. The glucose/fructose ratio was calculated by solving the simultaneous equations obtained from a iodimetric determination and from the estimation of reducing power by Fehling's solution. Fructose was also determined by diphenylamine with concordant results. Starch was estimated as glucose and maltose after digestion with takadiastase. The sum of these four individual carbohydrates was taken to represent the available carbohydrate of the fruit. [Authors' summary.]

7. PRIESTLEY, J. H. 581.11
Sap ascent in the tree.
Sci. Progr., 1935, 30 : 117 : 42-56, bibl. in text.

This paper is divided into two sections :—1, some criticisms of the cohesion theory, and 2, vessel differentiation and water movement into the bud. The author discusses these problems in the light of his own and other investigations, and sums up as follows :—"Our main thesis has been

8.	DAWE, C. V., AND BLUNDELL, J. E. Basket willow growing in Somerset : a depressed industry. <i>Fm. Econ.</i> , 1935, 1 : 240-2.	634.973.623
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TREE FRUITS, DECIDUOUS.

9.	BUNYARD, E. A. Cherries and their varieties. <i>Cherries and soft fruits: varieties and cultivation in 1935</i> , 1935, pp. 11-8, Roy. hort. Soc., London, 6s.	634.23
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Cherries are classified as sweet or sour. Sweet cherries belonging to *Prunus Avium* may be subdivided into tender-fleshed Geans, black or white, and firm-fleshed Bigarreaux, black or white. Sour cherries belonging to *Prunus Cerasus* may be divided into the red varieties, Amarelles, and the black varieties, Morellos. Intermediate and suggesting hybrid origin are the Duke cherries, also red and black. Varieties belonging to each of these groups are discussed with special reference to garden purposes, a short list of selected varieties being given at the end. In a brief section on cultivation the author states that probably the worst enemy of the cherry is excess of nitrogen. Next to this comes the black fly.

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| 10. | DOUBLEDAY, L. | 634.23 |
| | Cherries for market growing purposes. | |
| | <i>Cherries and soft fruits: varieties and cultivation in 1935</i> , 1935, pp. 6-10,
Roy. hort. Soc., London, 6s. | |

Unlike most other fruit crops, in which outstanding types have been limited to a few widely grown varieties, cherries still show 40-50 varieties which are considered quite good commercially. In selecting the best types to grow there are five main factors which should be considered. (1) A succession of varieties requiring an even seasonal distribution of labour. (2) The suitability of district and soil to the various types. (3) Tree health and vigour is not shown equally by all varieties, and is important in considering the best spacing between trees and the question of interplanting with less vigorous types. (4) Pollination. Blocks of one variety should never be planted, and fertile types should be planted in the immediate vicinity of self-sterile varieties. (5) Fruit quality is of paramount importance. The author proceeds to discuss a number of varieties in the light of the above qualifications.

11. CHARLEY, V. L. S.

663.3

Fruit requirements for the cider industry.*Sci. Hort.*, 1936, 4: 59-66, bibl. 2.

The author notes the definitely rising demand for good quality cider in England. He next considers the raw material available to cope with this demand, and the parlous state into which old cider orchards in the west country have been allowed to fall. Cull apples of other types cannot entirely replace the true, bittersweet cider apple with its high tannin content, and it is essential that provision should be made in the shortest possible time of the true cider apple in large quantity. A certain amount can be done by spraying, but present cider trees run very large and the use of power sprays delivering the spray fluid under a pressure of 250/300 lb. per square inch is essential. In many cases orchards are beyond such treatment. For new plantings it is suggested that only a few of the known 1,000 varieties of cider apples should be used in order to facilitate the production of a standardized product. A short list of recommended varieties is given, together with notes on normal planting practice. Attention is also called to the success achieved by top grafting old and sound trees, which at present produce not too popular culinary or dessert fruit, with bittersweet varieties, and to the work at Long Ashton where trials are now being made of working dwarfing stocks I and IX with cider varieties and growing under cultivated conditions until the trees are well established. It is estimated that such trees should produce 5 tons of fruit per acre when 12 years old, but one cannot as yet be absolutely sure that the vintage quality of the juice will be the same as that of similar varieties grown from the start under the traditional west country grass conditions. This remains to be seen.

*Propagation.**

12. GARNER, R. J.

634.1/2-1.541.44

The rapid conversion of unprofitable fruit trees by grafting.Reprinted from *The Berkshire Farmers' Year Book*, 1936, pp. 8.

The common method of topworking fruit trees with more valuable varieties involves "deheading". The main disadvantages of this system are the time taken by the tree to produce a new framework, the upsetting of the balance between root and shoot resulting possibly in ill health, and the production of large wounds. In this paper four fairly recent methods of top-grafting are described, in which the complete original framework of the tree is retained. Owing to the confusion of nomenclature that has arisen, the term "frameworking" is suggested to cover all four methods. These are as follows:—(1) *Framework-budding*. Buds are inserted in the normal manner in August near the base of small lateral shoots. The production of these shoots is first encouraged by pruning during the preceding winter and they are subsequently thinned out to a spacing of 8"-12" when still less than 3" long during the summer. The system has the advantage of economy in scion material, but the disadvantages that August is a busy season for fruitgrowers, that the buds require tying which is laborious, that a season is wasted producing the necessary lateral shoots, and finally, that with many varieties the growth from a single bud is often so vigorous that a second season is required before a return to fruiting can be induced. The use of framework-budding is, therefore, not recommended. (2) *Porcupine-grafting*. The tree is cleared of all laterals at any time during the dormant season prior to grafting. In early April, or whenever the rind and wood will part easily, grafts bearing 4 to 6 buds, with a simple slanting cut $1\frac{1}{2}$ "-2" long at the base, are inserted into inverted L-shaped cuts made in the rind of the main branch at the required spacing. A $\frac{3}{8}$ " gimppin or other suitable small nail is driven through the raised bark and scion into the wood to hold the graft firmly in position. All cut surfaces are covered with grafting wax or other suitable material. (3) *Stub-grafting*. Surplus lateral growths are removed during winter, leaving small side shoots $\frac{1}{4}$ "-1" in diameter wherever lateral branches of the new variety are required. Scions with 4-6 buds are prepared by cutting the basal ends in the form of a wedge. A slanting cut is made in each shoot to be grafted near the main branch, the shoot is bent down to open the cut, and the scion is inserted. The lateral

* See also 4, 123, 124.

is released to hold the scion firmly, and is cut back to immediately above the graft, and finally grafting wax is applied. March-April is probably the best period for stub-grafting, but successful unions have been made at various times between February and mid-July. (4) *Side-grafting*. Porcupine-grafting may be used for varieties possessing very few laterals suitable for stub-grafting, provided those branches are of sufficient size. Branches less than $1\frac{1}{2}$ " in diameter are, however, best dealt with by side-grafting. The scions in this case are prepared as for stub-grafting though with the basal wedge more tapering. A cut at an angle of about 20° is made in the branch, which is bent down to open the cut and receive the scion. The branch is released to grip the scion, and grafting wax is applied. After grafting or budding the only further attention necessary in all cases is the removal of suckers of the original variety. The results of several trials with apples and one with plums are outlined. In summarizing the author states, "The simplicity of stub-grafting makes it the ideal method of frameworking for trees possessing suitable lateral shoots. Large branches devoid of laterals lend themselves best to porcupine-grafting, while small bare branches are most suitable for side-grafting. It will be noticed that the whole tree may be frameworked without the use of any tying material whatsoever." Trees so treated may fruit to some extent in the year of grafting, and produce a fair crop the following year. Moreover, losses due to death of trees are practically eliminated, and these advantages are held to outweigh the additional cost above that of the usual system of "deheading" and topworking.

Rootstocks.

13. HATTON, R. G. 634.11-1.541.11
Apple rootstock studies. Effect of layered stocks upon the vigour and cropping of certain scions.
J. Pomol., 1935, 13 : 293-350, bibl. 60.

This paper brings us a step further on the road previously mapped out by the author in the *J. Pomol.*, 1920, 2 : 1-10, *Ibid.*, 1927, 6 : 1-28, *J. roy. hort. Soc.*, 1930, 55 : 170-211, *H.A.*, 1931, 1 : 1 : 29, and by R. T. Pearl, in *J. S.E.A. Coll.*, Wye, 1932, No. 30, pp. 194-214, *H.A.*, 1932, 2 : 3 : 218. The author presents this as a further report and curbs any premature certainty by the suggestion that the complete picture of the initial plantings will in all probability take another 20 years to fill in. The report is so full of practical observations on particular phenomena as to defy justice being done to it by an abstract. The following notes are taken from the author's summary:—Previous reports are summarized and the origin, propagation and method of working the rootstocks and their subsequent cultural treatment are described. The possible subsequent effects of cultural treatment are discussed. The incidence of scion rooting with one variety used, namely Bramley's Seedling, on IX and VIII and to a less extent on II and VII is recorded. The effects of stock on tree growth as affecting the different manifestations of growth are compared and discussed. Changes in the relative order of vigour as expressed by total wood growth are reported. That the terms "dwarfing" and "vigorous" are relative only is shown by a consideration of the cross section of stems of different scions on the same rootstock. Nos. VIII, IX, IV, VII, X, XII and XVI appear to exert relatively the same influence on the 4 scion varieties used, i.e. Lane's Prince Albert, Bramley's Seedling, Worcester Pearmain and Cox's Orange Pippin, whereas definite scion partialities are apparent now on Nos. I, II, V, and VI. The influence of stock on the habit of growth in the scion is illustrated. Total weights of the different parts of some 246 14- and 16-year-old trees show scions on very vigorous rootstocks to be 4 or 5 times as heavy as those on very dwarfing stocks. Different stocks modify the ratio of tree weight to cross section of trunk for a single scion variety. The outstanding behaviour of trees on IX and IV emphasizes the effect of rootstock on earliness in coming into bearing. An attempt to trace the effect of early cropping on ultimate vigour is made by comparing the additional wood growth, stem increment and crop weight from year to year. Total crop per tree at any one period obscures the real cropping history of particular combinations. Scion preferences are evident. A fair comparison can however be made between the average total crops for the 4 varieties upon certain stocks with trees of approximately the same size and

maturity. Total crop in relation to total branch and stem weight strikingly demonstrates rootstock influence. On IX trees of one variety have produced 7.5 times their own weight in 14 years, whereas on XII weights are approximately equal. The considerable effect of rootstock on size of fruit is illustrated. The evidence of rootstock effect in all spheres of scion growth, on storage quality, chemical composition of fruit and on resistance to disease and physiological disorder is summarized. Various attempts to elucidate the causes and mechanism of rootstock effect are reviewed.

Rootgrowth.

14. NIGHTINGALE, G. T. 581.144.2 : 551.52 : 634.11 + 634.25
Effects of temperature on growth, anatomy and metabolism of apple and peach roots.
Bot. Gaz., 1935, 96 : 581-637, bibl. 34.

The effects of nine different temperatures ranging from 45° to 95° F. on the amount, quality and structure of the root system and on the chemical composition of the roots of young apple and peach trees are recorded over a period of two months. The tops of root-grafted Stayman apple trees and one-year-old Elberta peach trees were severely pruned and all the small roots removed, before planting. The trees were grown in sand in self-draining culture jars standing in water baths, which were thermostatically controlled to give sand temperatures of 45°, 50°, 55°, 60°, 65°, 75°, 85°, 90° and 95° F. The air temperature was 60°-65° at night and 65°-70° during the day. Some of the trees received a complete water culture solution and some a solution lacking nitrogen. The trees were inactive when the experimental treatments were begun. The following remarks apply to both apple and peach trees, as they behaved alike in most instances. The greatest amount of new roots and shoots was produced at 65°. At 45° root primordia were present, but at 95° no new roots appeared and the old roots eventually died. Comparatively small differences in temperature caused large alterations in the amount of roots produced, for example, at 85° the root systems were extremely small, yet at 75° there was a large volume of roots. The character of the roots produced at different temperatures varied greatly. At 65° and below the new roots were typically white, of relatively large diameter, very succulent and lacking in mechanical strength, while at 75° the cortex turned brown and gradually sloughed off leaving the central portion of the root, which was typically very woody, of considerable mechanical strength, and lacking in succulence. Many fine lateral roots were present at 75°. At 85° and 95° the roots were similar to those at 75° in appearance but were smaller in diameter and less extensive. The pruning wounds, which were present at the beginning of the experiment on old roots, callused over earliest at 85° and 90°. The fact that more or less satisfactory callusing occurred at 85°, a temperature at least 10° higher than that which could be considered favourable for root growth under the conditions of these experiments, may be of practical significance in propagation. At 65° the development of secondary tissues and of lignified xylem was slow. At 75° an active cork cambium developed and produced, externally, cells that suberized rapidly, and internally, parenchymatous cells and many heavy walled fibres. The stellar cambium was also active and formed a considerable amount of secondary phloem and xylem ; many phloem fibres were present and with the exception of the ray cells the entire xylem was thick-walled and lignified. At 85° and 90° the cortex died early, the phloem and xylem was limited in extent and the stellar cambium only a few cells wide in transverse section. Young cortical cells gave a pH value of 5.2-4.8 and mature cells a value of 4.4-4.2. Young phloem cells gave a pH of 6.2-5.9 and mature cells 5.2-4.8. Lignified cells gave a "so-called pH value" of 4.4-4.0. Nitrate was freely absorbed by the new roots and was entirely limited to these organs. The temperature had little effect upon the ability of the roots to absorb nitrate but had a marked influence on their ability to reduce nitrate to nitrite, ammonium and amino acids. There was a considerable increase in the rate of nitrate reduction from low to high temperatures. The highest absolute reduction of nitrate was, however, found to be at 65° where the greatest growth of new roots and shoots occurred and where there was a high proportion of

active, less acid tissues and a low proportion of inert, more acid elements such as fibres, xylem and suberized periderm. With the reduction of nitrate necessarily occurs the oxidation of carbohydrates. Analyses showed that where nitrate was reduced carbohydrates were lower than in comparable cultures which received no external source of nitrogen. Trees at 55° and lower had a high percentage of reducing sugars and sucrose but were low in starch. At 75° and above the percentage of dry matter was high. A.B.B.

Pollination.

15. BLINOFF, L. F. 634.11 : 581.162.3
Die Bestäubung und Fruchtbarkeit der Apfelbäume. (**Pollination and fruitfulness in apples.**)
Gartenbauwiss., 1935, 9 : 460-5.

A very large orchard of Antonowka apple trees at Saburovo, U.S.S.R., continued to yield badly despite all attempts to improve cultural conditions. Analyses of records taken subsequent to 1930 showed that the cause was ineffective pollination. Koritschnoje appears to be a good pollinator for Antonowka, provided that it is present in adequate numbers and properly interspersed.

16. BALDINI, G. F. 634.22 : 581.162.3
Fiori aginici sul susino "Santarosa". (**Imperfect flowers in the Santarosa plum.**)
Ital. agric., 1935, 72 : 759-64, bibl. 14.

The author's conclusions are based on observations made in 1932 on well-grown 6-year-old Santarosa plum trees worked on myrobolan. Examination of a large number of flowers at all stages of floral development showed that in many of them the place of the pistil was taken by a variously shaped body of a clear bright green colour, usually rounded and sometimes with an appendage dark at the tip which turned down from the centre. It was found that some 30% of all the flowers examined showed this phenomenon. But not all the imperfect flowers examined showed this particular anomaly. In some 20% of them in the place where the pistil normally stands a small dark dry body was found about 4 mm. long and generally inclined to one side. This body had in all probability originally been the pistil and its present state was probably the effect of the tissues being killed as the result of cold or rain. A consideration of the weather conditions obtaining immediately preceding the examination tends to confirm this theory. It would then appear that some 30% of the flowers of Santarosa are sterile owing to natural atrophy of the pistil and also that a fall in temperature to 5° C. (41° F.) at the critical time may also result in sterility of stigma and style.

17. RUDLOFF, C. F., AND SCHANDERL, H. 581.162.3 : 634.21 + 634.25 + 634.55
Befruchtungsbiologische Studien an Aprikosen, Pfirsichen und Mandeln.
(**Pollination of apricots, peaches and almonds in Germany.**)
Gartenbauwiss., 1935, 9 : 500-8, bibl. 18.

The pollination trials on apricots and peaches were carried out in 1931, 1933, 1934 and 1935, those on almonds in 1935 only. All were submitted to cross- and self-pollination tests and to pollen germination tests. Of the 31 apricot varieties 19 proved sufficiently self-fertile, the remainder doubtful. Of the 46 peach varieties examined 33 were found self-fertile. The remainder like the doubtful apricots need further trial. Indications were given that crops of peaches and apricot are not noticeably increased by cross-pollination. The four almond varieties tested were all self-sterile. In one variety (B) the ovaries were absent in nearly all the flowers. In this case then self-sterility was due to degeneration of the female organs. The others showed fertility which varied according to the pollinating variety. Pollen germination was high in all three species, especially in the almond. In no case was refusal to germinate encountered.

18. JAHN, A. 634.13 : 581.162.3
Entwicklungs-und pollenphysiologische Verhältnisse bei der Staubblattumwandlung von *Pirus communis*. (**Conditions of growth and pollen physiology present during stamen metamorphosis in the pear.**)
Angew. Bot., 1935, 17 : 303-23, bibl. 3.

The author describes with the help of drawings and micro-photographs of sections at different epochs the anatomical changes which occur during the fairly common phenomenon in pears of stamens changing into petals. In the second part of the paper he shows how this change and the consequent reduction of anthers necessarily result in lessening the amount of pollen available but also that the germination of the pollen which is still available remains unimpaired. The observations were made at Veithöchsheim on the variety Clapp's Favourite.

19. KRUMBHOLZ, G. 634.11 : 581.46
Beiträge zur Morphologie der Apfelblüte. I. Mitteilung. Ueber die Zahl der Samenanlagen in den Blüten in ihrer Abhängigkeit vom Genotypus und der Stellung der Blüte im Blütenstand. (**First report on the morphology of apple blossom. The number of ovules in the flower in relation to genotype and the position of the flower in the cluster.**)
Gartenbauwiss., 1935, 9 : 509-57, bibl. 11.

It is shown that in many apple varieties the middle flower of each cluster differs from the lateral flowers by its greater number of ovules. The following types can be differentiated :—1, Varieties with ± 10 ovules in the middle and the lateral flowers. 2, Varieties with generally more than 10 (up to 20) ovules in the middle flowers and with ± 10 (seldom many more) ovules in the lateral flowers. 3, Varieties with more numerous ovules (up to 20 a flower) in the middle and lateral flowers, the middle flowers generally containing more ovules than the laterals. Certain varieties are noticeable for the fact that generally the middle flowers possess normal 5-chambered ovaries, but the laterals 4- or even 3-chambered ovaries. Judged by these characters the apples examined are divided into 5 groups. The same phenomenon may be observed in distant groups of the genus *Malus*, whereas all the pear varieties tested showed normal 5-chambered ovaries with 2 ovules in each chamber. The author discusses the importance of the phenomenon to classification, phylogeny and genetics and above all to fruit set and fruit formation, and stresses the necessity for far-reaching experiments, in which particular attention will be paid to differences between different varieties.

20. DAHL, C. G. 634.22 : 581.46
Morphological studies of plum flowers. [In English.]
Contr. Swedish permanent committee on orchard research, 38, 1935, pp. 93, bibl. 52, reprinted from *Årsskr. Från. Alnarps Landbruks, Mejeriöch Trädgårds-institut år 1935*.

A collection of about 150 plum varieties growing in the Gardens of Alnarp, Sweden, has provided the material for this study. The general conclusion is drawn that the flowers of plums possess characteristics which are at least of equal value to those of the fruits as a means of distinguishing varieties. The features considered important are the season of flowering, and the characters of the pedicel, receptacle, sepals, corolla, petals, stamens, pistils, and of the leaves at the time of flowering. On a basis of these characters some 127 varieties, which appear to be correctly named, are described, each with an accompanying photograph of a flower or flower cluster. An analytical key to a number of plums belonging to the *domestica*- and *insititia*-types is appended, which the author states can only be regarded as of a preliminary and incomplete nature, but which may prove of assistance in further studies.

21. HARROLD, T. J. 634.22 : 581.145.2
Comparative study of the developing and aborting fruits of *Prunus persica*.
Bot. Gaz., 1935, 96 : 505-20, bibl. 13, being *Contrib. Hull bot. Lab.* 459.

The variety of peach, *Prunus persica* Sieb. & Zucc., used in the study here described was Carman. The fall of flowers and fruits occurs in waves denoted as the first, second, and third drops. The

first drop covers a period of approximately 3 weeks starting 1-3 days before full bloom, and consists of buds and flowers with and without petals. The second drop occurs during some 7 days about the fifth week after flowering, dropped fruits being 8-14 mm. long compared with developing fruits 20-27 mm. The third wave again lasts about 7 days, and occurs about the seventh week after flowering, the dropped fruits being variable in size, but again smaller than normal. External morphological distinctions between aborting and normal fruits are described in each case. Total abortion was assessed by subtracting the number of fruits left after the third drop from the original number of blossoms. Normal and aborting fruits were also subjected to a microscopic study. In the normal fruit the development of the megagametophyte resembles that established for other members of the genus *Prunus*. In the case of aborting fruits each of the three distinct waves of dropping bore a constant relation to the developing pistil. The only apparent difference between aborting and developing fruits is that growth in the former ceases and in the latter continues. In other words at the time of falling the aborting fruits differ from developing fruits mainly in the degree of development of normal parts. The first drop is associated with cessation of development of stages leading up to the gametophyte and also of gametophytes themselves, and of zygote and primary endosperm nucleus. The two later drops are associated with the cessation of embryo and endosperm development. The occurrence of a disorder noted in the region of the chalaza may, however, possibly precede the cessation of gametophyte or of embryo development, and suggests that disarrangement caused to the vascular system in this region, and not embryo abortion, may be the cause of the fruit falling.

22. NEWMAN, L. J.

634.37 : 581.162.3

Fig wasp (*Blastophaga psenes*).

J. Dep. Agric. W. Aust., 1935, 12 (second series) : 476-9.

Attempts to establish the wasp and the Capri fig in Western Australia finally succeeded in 1919. The way in which the wasp acts as pollen carrier from the Capri to the Smyrna fig is described. The best known varieties of Capri fig in the State are Roeding's Capri Nos. 1, 2, and 3, Robson's Special Capri from S. Australia and a local seedling named Simmon's Capri. The latter is proving particularly successful as the host fruit in coastal areas. To assist cross-fertilization Capri figs are picked between 15th and 20th December, and, placed in open receptacles of wire netting or tied on to strings, are suspended in the Smyrna trees. The fruits of the latter are receptive from the time they are $\frac{3}{8}$ " to 1" in diameter. Under local conditions the wasp produces four generations during the year, 15th-20th December, 1st-5th February, 15th-20th March, and 15th-20th September. Securing a continuity of Capri fruits to fit in with these generations has proved one of the difficulties in establishing the wasp. Experiments have shown that by pinching back strong lateral growths of Roeding's Capri No. 3 to two buds, working gradually at a rate of say two laterals a day, between 24th October and 7th November an extra crop of Capri figs is produced, which are receptive between 15th and 20th December. Wasps will emerge from these between the 1st and 8th February, when Roeding's Capri No. 1 is at the right stage for egg laying. This crop if set by the wasp will hang on the trees over the winter, and provide a useful addition to the crop set in March, which is often very small.

Growth, nutrition.

23. CLEMENTS, H. F.

581.113/4 : 634.11

Morphology and physiology of the pome lenticels of *Pyrus Malus*.

Bot. Gaz., 1935, 97 : 101-17, bibl. 10.

The term lenticel is used to indicate the white, green, or yellowish brown spots common to all apple fruits. Their morphology is described, and distinctions are drawn between them and the lenticels of woody stems. The number of lenticels was compared for 18 horticultural varieties of apple, and was found to be in general characteristic of the variety, although modified to some extent by ecological conditions under which the apple was produced. A range from 450-800 in the case of Winesap to 1,500-2,500 in the case of Spitzenburg was found. Increasing irrigation

during the early development of the fruits led to an increase in the number of lenticels on Winesap apples, but to a decrease in the number on Delicious apples, thus showing the reaction to be varietal rather than general. Lenticels may be open or closed according to the character of the hypodermal cells. They are rendered closed when cutinized or suberized, or when the stoma associated with the lenticel is closed over by means of the epidermal cuticle. They may be closed after picking by processes favouring dehydration of the outer tissues of the apple. The response is more rapid with immature apples. Fruit which has been stored for 6-8 weeks responds to low humidities only after prolonged treatment. The rate and course of diffusion of carbon dioxide gas from apples was studied with Delicious fruits taken from store at 1°C. and placed in a chamber at 25°C. The rate of escape of gas from apples with many or few open lenticels was the same. It is, therefore, suggested that the gas probably moves directly through the cuticle. The internal temperatures of the apples were within 0.5°C. of the room temperature after 3½ hours, but the period necessary for the gas to come to equilibrium was 49 to 52 hours, the former applying to an apple with many open lenticels, and the latter to one with only two open lenticels. Winesap apples, though under one-third the size of the Delicious fruits, also averaged 51 hours.

24. FILEWICZ, W.

634.11 : 581.144.4

Foliage colour and crop in apples. [In Polish.]

Gielda Ogrodnicza, Dec. 31, 1935.

Observations have been made in 1933, 1934, and 1935 on the colour of the leaves in connexion with the amount of crop in Landsberger Reinette, Boiken and Antonowka apple trees, all naturally biennial bearers. It was found that trees in their off year showed in autumn a less intense green or a yellower colour in their leaves than trees in their on year. It is suggested that the off year trees have then accumulated enough nutrients to ensure the maturing of shoots and leaves, whereas the on year trees with their green leaves have expended food on fruit development with the result that there is a delay in the maturity of the shoots, and this is shown by the retention of the green colour. It was also observed that the non-bearing trees may tend to make less terminal growth on the main branches.

W.F. (author).

25. GANE, R.

664.85.11 : 581.192

The formation of ethylene by plant tissues, and its significance in the ripening of fruits.

J. Pomol., 1935, 13 : 351-8, bibl. 11.

Chemical tests of the active gaseous substance generated by ripe apples show it to be identical with ethylene. It is found to have the normal effects on plant growth which arise from treatment with low concentrations of ethylene, e.g. epinastic symptoms in the petioles and leaves. The author describes his methods of testing the action of the gas and of identifying it chemically. He considers that the function of this substance may be of the following nature. "Prior to the climacteric rise in respiratory activity which marks the onset of ripening, apples and bananas have been shown to be sensitive to an active substance produced by them once ripening has begun. Directly the climacteric rise in respiratory activity has begun they are no longer sensitive. The change induced by the substance thus appears to be final and irreversible. Hence if this critical change has occurred in any part of the tissue, it must through the action of the substance be rapidly spread through the whole fruit, and since this substance is volatile it must spread to neighbouring fruits."

26. VERNER, L.

634.11-2.19

A physiological study of cracking in Stayman Winesap apples.

J. agric. Res., 1935, 51 : 191-222, bibl. 29.

The cracking of Stayman Winesap apples was subjected to a detailed investigation at Kearneysville, W. Virginia. Some writers suggest that the major factor responsible for cracking of various fruits is a sudden, marked increase in soil moisture content, but the results described here do not support this. A definite association was, however, always found between low rates

of evaporation and the occurrence of cracking, and outbreaks were generally preceded by markedly depressed transpiration maintained for 6 hours or more. Although rainfall as associated with soil moisture content was found to have no effect upon cracking, it appears to have a marked influence when forming a film of water over fruit and leaf surfaces. Considerable water absorption may occur under this condition, while at the same time transpiration is retarded or prevented. Severe cracking was induced both when branches bearing attached apples and when detached apples alone were submerged in water for several days. Conversely, enclosing attached apples in paper bags to prevent contact with rain water markedly reduced cracking. The artificial protection of branches from rain did not, however, entirely eliminate cracking, and it is therefore thought that the presence of a film of water on the foliage, or fruit, or both is not a condition essential to the promotion of cracking. No correlation was found between the occurrence or severity of cracking and air temperature fluctuations. A study of individual fruits was also undertaken to determine why cracking was limited to certain specimens on a branch and not to others similarly situated. The great majority of the observations made indicate that the injury was first initiated in a region of the fruit showing some form of visible abnormality or modification of peripheral tissues, such as russetting, scab lesions, sunscald, or unusually high colour. Measurements of internal osmotic values showed, in almost every case, that tissues from regions beneath modified areas of the periphery had significantly higher pressures than similar tissues underlying normal areas. Thus the state immediately conducive to cracking appears to be characterized by a combination of mechanical weakness of the modified surface areas, and also by exceptionally high pressures in the tissues underneath these areas.

27. KERTESZ, Z. I., AND NEBEL, B. R. 634.23-2.1
Observations on the cracking of cherries.
Plant Physiol., 1935, 10 : 763-72, bibl. 9, being *Journal Paper N.Y. agric. Exp. Sta.*, 62, 1934.

Preliminary results are reported of cracking tests on cherries of different varieties, together with anatomical and physiological observations. In general the description "cherries prone to crack" is broadly applicable to hard-fleshed varieties, and "cherries not prone to crack" to soft-fleshed varieties. A morphological examination of the fruits of different varieties showed that in types prone to cracking the size of the sub-epidermal cells is appreciably smaller, and the number per given area correspondingly greater, than in types not prone to cracking. Moreover in the former the average cell size is decreased by the frequent interspersation of small cells among the large parenchymatous cells of the flesh, whereas in the latter the average cell size is more uniform as well as larger. No correlation was found between the size of epidermal cells and cracking, but an unexplained positive correlation appears to exist between the thickness of the inner wall of the epidermis and proneness to cracking. Fruits of 10 varieties were submerged with stems attached for various periods in solutions containing different percentages of sucrose, and in water. Less cracking occurred in the sugar solutions than in water, and in the case of a 23.2% sucrose solution (the highest concentration used) no cracking was observed after 18 hours immersion. In both water and sugar solutions all the cherries increased in weight indicating that they took up water. No correlation could be shown between water absorption and cracking within any one variety, but the water uptake in the group of non-cracking cherries was distinctly lower than in the group of cherries prone to cracking, thus indicating a difference in saturation deficiency of the fruits of the two groups. Further experiments with pulped sweet and sour cherries supplied evidence that cracking is caused by the forces of the swelling colloids rather than by osmotic forces.

28. SMITH, W. W. 634.13 : 581.47
The course of the stone cell formation in pear fruits.
Plant Physiol., 1935, 10 : 587-611, bibl. 37.

The results of investigations during 1930 and 1931 on Kieffer and Bartlett pears and on Wagener apples supported the supposition that lignocellulose may be converted in maturing fruits to reducing materials. A quantitative determination of these materials in the Kieffer pear and

Wagener apple in 1933 indicated, however, that no actual decrease of lignocellulose occurred, although the percentage decreased rapidly on account of great increases in alcohol-soluble materials. This shows that lignocellulose does not in fact break down in these fruits during growth to form less complex materials. The amount of grit cells in pears depends mainly on the extent of grit cell formation during the early stages of fruit development, and this amount is not subsequently reduced by changes in the fruit during ripening.

29. PITMAN, G. 634.63-1.547.6 : 581.192

Oil content as a criterion of olive maturity.

J. Ass. off. agric. Chem., 1935, **18** : 441-54, bibl. in text.

Improved methods of pickling olives are thought to make possible the utilization of reasonably ripe fruits of certain varieties, which hitherto had to be harvested when relatively immature. The work described in this paper was undertaken to supplement existing maturity standards, which are based largely on personal judgment, and are thus subject to inaccuracies. Analyses of five varieties of olive in two seasons and in a number of different localities showed that the oil content varies greatly with both variety and locality, but none the less it is considered to be the most dependable measure of maturity available. A close parallel was, however, found between the moisture content of the fresh fruit and the oil content on the wet basis. In searching for an external character which might serve to indicate the oil content, colour, divided into 6 groups, was found to be more reliable than size. The tendency for larger olives to possess a higher oil content than small ones is probably due to the higher proportion of green fruits in the small sizes. As regards locality olives from northern California had a somewhat higher oil content than did olives from south-central and southern California. The effect of soil type appears to be very slight, although there is a tendency for trees on heavy soils to produce fruit with a higher oil content than those growing on sandy soils. The date of picking appears to have an important influence on oil content. In general olives of a given colour picked later in the season had a higher oil content than olives of the same colour picked earlier. This increase is not, however, necessarily uniform when the estimation is made on the wet basis, because factors, such as heavy rainfall, may cause rapid increases in weight. Furthermore this increase in oil content is not so great as was generally held to be the case. Finally analyses of olives made before and after pickling indicated that a marked decrease in oil content occurs during either pickling or sterilization, and this loss should be considered when minimum standards are established.

Cultural practice, manuring, irrigation.

30. VILHENA, M. 634.38

Organização de um amoreiral. (Organization of a mulberry grove.)

Bol. Agric. Zootech. Vet. Minas Geraes, 1935, **8** : 7-10.

Mulberries are grown in Brazil principally to provide food for silkworms, the fruit being largely disregarded. In Brazil the mulberry succeeds best on high sunny ground, moderately fertile, with a deep, rather light soil. An economical planting arrangement is to set out the trees round the boundaries of orchards or other crop lands, or on waste ground that cannot conveniently carry more exacting crops. Planting in the nursery should be done in the rainy season, in this case in August and September, and the preparation of the site for the nursery should have taken place two or three months previously and not, the author remarks, just the day before it is required. The cuttings are made of ripened wood and are 40 cm. long, of finger thickness and carry 4-5 buds. They are taken from trees which bear in quantity the most suitable leaves. The cuttings are set in the soil on the slant to two-thirds of their length, 20 cm. apart and 40 cm. between the rows. Weeds must be kept down. Transplanting to permanent positions should be possible in a year. It is detrimental to leave the plants over long in the nursery. Suitable planting distances are from 3 m. × 3 m. to 5 m. × 5 m., the wider spacing being for the more fertile ground. No more trees should be lifted than can be replanted in the day, and undue exposure of the roots should be avoided. The trees should be cut back to within 0.50 m. of the ground, and should subsequently be kept low, so that leaf picking and cultural treatments can

be carried out without the use of ladders. All the leaves and shoots remaining on the trunk after cutting back should be removed when transplanting with the exception of the 3 topmost shoots or buds, which should point in different directions. When these buds have made wood, they are cut back to within approximately 20 cm. of the trunk, leaving 3 buds pointing in different directions, and when grown these in turn are cut back to within 20 cm. of their base. The ultimate aim of this pruning is to produce an open centred, vase-shaped tree. Pruning for yield varies with locality, but in general the object is to keep the branches open, to discourage fruiting and to maintain the shape of the tree. The small twiggy branches should be removed in preference to the larger ones. A warning is given against too severe plucking of the leaves of immature trees. This merely retards development and results in foliage which is unsuitable for the silkworms. Leaves should always be taken from mature branches. Notes of the cost of establishing and maintaining a plantation in Brazil and the prices to be expected from the sale of leaves are given.

31. BAGENAL, N. B., AND TURNER, A. D. 634.11-1.546
Dwarf pyramid apple culture at Cannington.
Sci. Hort., 1936, 4 : 67-74.

The work of Lorette on summer pruning and of the Long Ashton staff on the different factors influencing the formation of fruit buds formed the basis for the dwarf pyramid system which is now being tested at Cannington. The aim being the successful growth of anything from 1,200 to 2,300 trees per acre without wire, the requirements of the trees under varying growth conditions were bound to involve the grower in many problems of growth and nutrition. A combined demonstration and experiment plot was therefore established at Cannington on which it was proposed to study the suitability of rootstocks and varieties, the effect of pruning, cultivation and manuring in relation to nutrition, growth and cropping of the trees and the application of the system to commercial conditions. In this paper a short account is given of the shaping and pruning during the first two years after planting and of the ideas which underlie all treatments given. The time and severity of pruning is determined by the growth of the tree in summer and this in turn is modified by the age and bearing of the tree, soil and season and various other management factors. Success depends on the maintenance of a correct nutritional balance within the tree by checking growth and restricting leaf area at the right moment, namely after the first flush of exuberant growth but in time to influence fruit bud production. How pruning can do this is shown. Soil moisture conditions also need careful attention. In this experiment one section was kept under clean cultivation while four others were covered with :—(1) couch grass, (2) perennial rye grass, (3) permanent pasture mixture, (4) natural "tumbled down" weeds. Results show that at Cannington the permanent pasture mixture with considerable white clover in it gives the best results, but that soil and other local conditions must always govern the choice of cultivation. As regards manuring, nitro-chalk and sulphate of potash were applied to redress the balance of tree growth as and when symptoms of deficiency were noticeable in leaves, fruit or growth. The trials which have just completed their sixth year show quite promising results, the average yield per tree in 1933 being approximately 3 lb. and in 1934 approximately 5 lb. It is realized that in the next 5 years the horizontal fruiting branches will have reached their limits of allotted space and the various problems connected with restricted space between trees will have to be faced. The trial should get increasingly interesting.

32. ELLENWOOD, C. W. 634.11-1.543
Filler apple trees.
Bull. Ohio agric. Exp. Sta., 551, 1935, pp. 18, bibl. 7.

Yields and growth records, production costs and returns are presented for two apple orchards totalling 10.8 acres, and both containing permanent and filler trees. In orchard J Baldwin and Stayman were set in permanent positions 40' × 40' on the square. Wealthy and Stayman were planted as filler trees in one direction, so that the final spacing was 40' × 20'. In orchard K the permanent varieties were Stayman and Jonathan set 38' × 40' apart. Filler varieties were McIntosh and Grimes planted in one direction, and Stayman, Grimes, Arkansas and Winesap,

planted a year later in the other direction, thus giving a final spacing of 20' × 19'. This second filler row was removed at the end of the ninth growing season, but the remaining filler trees in both orchards are still standing. All filler varieties except Wealthy required restrictive pruning at the end of the twelfth year. Wealthy compared with Stayman in orchard J proved less valuable than was expected owing to its greater tendency towards a biennial bearing habit. Annual bearing is regarded as necessary when filler trees are set in the row with permanent trees, though less important when set in the centres of permanent squares. The value of Wealthy was further reduced by the inclusion of some trees not true to name and by higher mortality. Of the varieties in orchard K Grimes showed the highest mortality and Jonathan and Baldwin the lowest. The cost of growing individual trees, untrue to name, subnormal in growth, or which died within the 12-year period exceeded the value of the fruit they produced, but when the whole area of 10·8 acres is considered, the filler trees have proved profitable at the end of the twelfth year. The rows of trees in orchard K removed at the end of the ninth year just paid their way, but this was largely due to an exceptionally heavy crop in one year. The cost of pulling these trees using a tractor with direct hitch was 48 cents (2s.) a tree, but no figures are available for the cost of haulage, burning the brush, etc. Tackle might have to be used for older trees, and this would increase the expenses. Root distribution was examined in orchard J during the tenth growing season and showed that roots were extending outwards for more than 20 feet and were thus overlapping the roots of trees in the same row, that is 20 feet away. How soon this would affect the trees is unknown, but the maximum life of the fillers in these orchards is expected to be about 15 years, when restrictive pruning is employed for the more vigorous varieties, and a year or two longer for Grimes and Wealthy. Three factors considerably influence the use and planting of fillers:—the value of the land used, the fertility of the soil, and the price per bushel of fruit (especially that of the fillers).

33. UPSHALL, W. H.

634.1/2-1.546

Building desirable heads for fruit trees.

Canad. Horticulture, 1935, 58 : 25-6.

In young fruit trees of pre-bearing age it is desirable to limit pruning to a minimum consistent with the development of a satisfactory head. The tree may be trained in three ways :—(1) *open centre or vase shaped*, which has the disadvantages that heavy pruning is necessary and that the branches all arising at one point may induce splitting ; (2) *central leader*, in which the tree is strong but the lower limbs become excessively shaded and may die out ; (3) *modified central leader*, in which 3-5 main branches are developed in spiral arrangement 6"-8" apart on the stem, the leader being allowed to grow, but by careful pruning prevented from outstripping the lateral branches. This system is recommended for all fruit trees, although modification is necessary with peaches and some Japanese plums which do not naturally develop central leaders after heading back. The height of the head should be as low as possible without interfering with cultivation and it is suggested that for upright varieties the lowest branch might be about 20" and for spreading varieties 30" above the ground. Branches forming a narrow angle with the main stem present a point of weakness due to inclusions of bark in the crotch, and this supplies another argument in favour of minimum pruning to encourage early bearing, which will open up the tree to a marked extent. Heading back branches or the leader to a bud should, therefore, be strictly limited to balancing branch growths with one another, or to trees which have been partially dried out before planting or planted very late in the spring. The system of disbudding developed in the U.S. has been tested in Ontario with sweet cherries and apples. Buds selected on the one-year tree to form branches 6"-8" apart are left, and all other buds removed before bursting. In this way it has been possible to build the framework of the tree in a single season, and the amount of pruning necessary in subsequent years has been much reduced. To ensure that few if any of the selected buds fail to form branches, the one-year whip should be sturdy, at least 44" high above the union, and the root system well developed ; the tree should not be dried out and should be planted in the autumn or very early spring ; and finally care must be taken to avoid injuring the buds in cultivation. If this is done, there may be no advantage in leaving up to 3 buds near the site of each branch, as has been suggested in Illinois, although this

may encourage wider angled crotches in very upright varieties. The general adoption of the modified central leader system in Ontario is handicapped by the growers' normal practice of planting two-year or older trees, except in the case of peaches and sweet cherries. Trees for this purpose are trained in nursery rows in a manner much better suited to the open centre type. Moreover, from the nurseryman's standpoint the branching desirable in one-year-old trees for the modified central leader system is not adapted to nursery rows, and makes such trees more difficult to grade, bundle, and pack. The grower is therefore recommended to plant one-year-old trees, which he may train himself.

34. NEWMAN, J. E. 631.3.083/4
Small cultivators for horticultural purposes.
Sci. Hort., 1936, 4 : 90-6.

The author discusses the difficulties involved in the production of a machine which will be strong enough to do all the work required of it without becoming too heavy to handle, and he shows what devices have been evolved to overcome them. Motive power in the English makes is generally provided by a Villiers two-stroke air-cooled fly-wheel magneto engine. It is light and spare parts are easily obtainable. An alternative for rather heavier work is the Blackburne four-stroke engine. All the makes on the English market to-day are of the 2-wheeled type. The following tools can now be got for use with garden tractors :—ploughs of all types, disc harrows, hoes and cultivators, harrows, cambridge rollers, manure distributors, mowing machines and mowing attachments, spraying, dusting and pumping attachments, trailers for transport work. Pneumatic tyres are now beginning to oust steel wheels. A not very enthusiastic note is given on rotary cultivating attachments. The cost of a large rototiller with a working width of 21 inches is at present £120. The cost of a garden tractor varies from £36 to £65. These prices include a certain number of tools, but the cost of a complete set of implements as given above should amount to just over £100. Running costs are low, fuel consumption being about 1 gallon petrol plus $\frac{1}{2}$ gallon lubricating oil to 4-7 hours' work. Their durability is as yet unproved but there seems no reason why they should not last 6-7 years of some 100 working days a year.

35. GUSEVA, E. I., AND KILTCHESKII, A. L. 634.22-1.8
The influence of mineral fertilizers on the growth and productiveness of the plum "Italian Vengerka". [In Russian.]*
Bull. Sochi Zonal Fruit Exp. Sta., 8, 1934, pp. 103-19.

This bulletin gives the results of experiments on the manuring of plums at the Sochi Zonal Fruit Experiment Station and various Collective Farms. These experiments were begun as a result of an inspection of the plum orchards in several districts of the Black Sea Coast of the Caucasus. Reduced yields, poor growth and the pale colour of the foliage gave clear indications of an insufficiency of nutritive substances. The treatments at Sochi, on a slightly podsolized clayey soil (Ramman's brown earth), were NPK, NP, NK, PK and nil. The fertilizers were ammonium sulphate, superphosphate and 40% potassic salt, applied from approximately 5th March to 15th April. The authors conclude that as a result of the mountainous relief and abundant autumn and winter rainfall yearly manuring is necessary. N is the most necessary element for the plum, NPK, NP and NK all increasing both growth and yield considerably. PK gave no greater growth and a smaller yield than no manuring, this result being associated with a high initial set of fruits, of which a very small number reached maturity. Fruit ripened earliest with PK and latest with NPK. Trees manured with PK were severely damaged by pests. Further work is said to be necessary to determine the relative importance of P and K.

W.A.B.

36. READ, F. M., AND COLE, C. E. 634.11-1.8
Mineral nutrition in Victorian fruit trees.
J. Aust. Inst. agric. Sci., 1935, 1 : 33-4.

Sand culture experiments similar to those made at Long Ashton, England, have been in progress at Melbourne for several seasons. Jonathan apple trees growing in pure quartz sand have been

* Full translation available.

watered with nutrient solutions to determine the symptoms associated with deficiency of nitrogen, phosphorus, potassium, calcium and magnesium. These symptoms are described briefly in each case, and have already proved of diagnostic value in the field. Further experiments have shown that trees exhibiting acute symptoms return rapidly to normal when a complete nutrient solution is applied, leaf size and colour responding first. As a result of chemical analyses of whole plants the balance between minerals is stressed as appearing to be more important than the actual amounts of each present. It seems that deficiency of one may increase absorption of the others, and so throw the balance even further out.

37. BECKER-DILLINGEN, J. 634.23-1.8
Der Einfluss der Düngung bei Schattenmorellen. (**The effect of manuring on acid cherries.**)
Ernähr. Pfl., 1935, 31 : 383-6.

The variety in question was the Grosse lange Lotkirsche planted as one-year budded trees on Mahaleb in 1929 in light sandy soil. The treatments given were O, N, NP, NPKMg. and NPK. The average annual yields per tree (16 trees per treatment) in the years 1931-4 were as follows :—O 5 lb., N 5.3 lb., NP 6.5 lb., NPKMg. 8.5 lb., NPK (muriate) 5.5 lb. In another centre with 10-year-old trees (28 trees per treatment) results were O 29.2 lb., NK 30.8 lb., NPKMg. 37.1 lb., NPK (muriate) 36.5 lb.

38. ROTHE, G. 634.1/2-1.67-1.432
Wasserbedarf und Wasserversorgung der Obstbäume. (**Publications on water requirements of fruit trees and its supply in 1934 and 1935.**)
Forschungsdienst, 1936, 1 : 199-202, bibl. 17.

Two German authorities writing in 1933 and 1934 differ quite remarkably in their estimates of water requirements of fruit trees, Waurer reckoning 1,150-1,500 mm., according to spacing of trees, as the requisite amount for trees in grass or clover ley in Oberschlesien and Rothe 580 mm. for trees in the Lower Elbe marshes. It is uncertain whether measurements were made in exactly the same way, but in any case Waurer's figures are more generally accepted by scientific horticultural opinion in Germany. The amounts necessary must vary with the climatic conditions and with the water-holding capacity of the soil. Work and others in America have studied the effect of root reduction and of soil moisture on blossoming and fruiting. The presence of adequate water is essential at the time of blossom bud formation for the following year. In apples Magness, in eastern U.S.A., found its influence working up to but not later than August 1st. Since a drought may seriously affect the health of the whole tree, any practices tending to alleviate the effects are welcome. Among those found helpful in times of drought, or where drought often occurs, are fruit thinning, wider spacing of trees, absence of cover crops, cultivations and mulching. Actually in Germany complaints of ill effects of drought are usually heard when the rainfall does not exceed 500 mm. Overhead watering would appear to be basically sound. Ball suggests that by raising the air humidity and in cooling off the leaves overhead watering will be infinitely superior to ordinary watering in checking transpiration and fostering proper carbohydrate assimilation. Instances of too high a water table are quoted from Egypt, where Fikry showed that gumming occurred much more extensively in plums under high than under low water table conditions (*H.A.*, 1934, 4 : 4 : 525). It is suggested that German orchards probably suffered considerably by the heightened water tables in the years 1925-8, 1930 and 1931 and that much of the damage attributed to frost may be due to this. The whole question needs further examination under German [and other European—Ed.] conditions.

39. CHRISTIANSEN, J. E. 631.67
Measuring water for irrigation.
Bull. Calif. agric. Exp. Sta., 588, 1935, pp. 96, figs. 38, tabs. 17, bibl. in text.

The numerous ways by which irrigation water can be measured are described and discussed in detail, together with the hydraulic principles and formulae involved. Tables are included

indicating the rates of flow over weirs and through orifices and flumes, and also the dimensions, standard or recommended, for their construction. The author states that the paper is designed primarily to meet the needs of farmers, ditch tenders, and county agents, but has been expanded to include a discussion of some principles of water measurement and some methods with which farmers, etc., are not usually concerned, but which should interest students and engineers. This paper would appear to be one of the most complete guides to the measurement of irrigation water yet published.

40. MAGNESS, J. R., DEGMAN, E. S., AND FURR, J. R. 634.11-1.67
Soil moisture and irrigation investigations in eastern apple orchards.
Tech. Bull. U.S. Dep. Agric., **491**, 1935, pp. 36, bibl. 14.

Irrigation experiments were conducted in three blocks of 22-year-old apple trees in Maryland during the four years 1930 to 1933 inclusive. Block A consisted of very stunted York Imperial and Wealthy trees growing on very shallow, eroded, silt clay soil overlying shale, and was divided into two plots, one irrigated and one non-irrigated, but both seeded to alfalfa. Block B consisted of Rome Beauty and Oldenburg, also rather below normal size, growing on a silt clay soil containing considerable fine rock and overlying shale at about 2 feet. It consisted of four plots, one pair mulched with wheat straw in the spring of 1930 and again in 1932, irrigated and non-irrigated, and the second pair cultivated each spring, again irrigated and non-irrigated. Block C consisted of York Imperial trees of above normal size growing in deep clay loam soil, and contained four plots divided on a basis of grass mulch mown at intervals during the summer versus spring cultivation, both irrigated and non-irrigated. The average rainfall for this area from May 1st to October 30th is 19.97 inches. In 1930 there were only 10.1 inches during this period, but in all the other three years the mean was exceeded slightly. Fruit-growth measurements on a basis of volume showed that from 6-8 weeks after blossoming to shortly before harvest growth proceeds at an almost uniform rate, if all conditions are favourable, and in silt loam or silt clay soils of moderate texture it is not appreciably reduced by moisture shortage until at least the drier parts of the root-zone approach the wilting percentage. On the breaking of a drought period, provided it has not been sufficiently severe to cause serious defoliation, fruit growth is apparently resumed at a normal rate. There is, however, no tendency following a check to accelerate the growth rate, and thus the size of the fruit at the end of the season will be reduced in proportion to the length and duration of the drought, even if only a short period occurs. In the present experiments in all four years, despite the above normal rainfall in three of them the trees growing in the rather shallow shale subsoil showed reduced fruit-growth rate. In Block B irrigation increased the yields of Rome Beauty harvested in early October by an average of over 50% due to increased size, but had little effect on Oldenburg, which was harvested in late July and was therefore unaffected by drought periods during the latter part of the summer. The effect of irrigation on the Rome Beauty apples was repeated, though in not quite so marked a manner, in two separate one-year trials with Delicious apples, and in the York Imperial apples in Block C, the former being harvested at the end of September and the latter towards mid-October. Colour development attained a maximum both in brightness and in area with moderate available moisture during the latter-part of the growing season. Lack of moisture during ripening made the colour dull and lifeless, and excessive moisture also tended to reduce it. Fruit-bud formation appears to be increased by moisture shortage occurring not later than early July, subsequent moisture shortage having no effect. Irrigation under these conditions did not, however, correct the biennial bearing tendency of the trees. In studying the physiological influence of reduced moisture supply the first measurable effect is an earlier closing of the stomata. This apparently reduces leaf function, and as a result total carbohydrate materials in the tree become less than under conditions of ample moisture supply. This applies in particular to starch which is much lower following drought, whereas sugar in the bark and wood are somewhat higher. Comparing mulched with non-mulched plots, both non-irrigated, there was a tendency in all seasons for Rome Beauty apples and in most cases for Oldenburg apples for the former to be larger. The effects of mulching in keeping down weeds, reducing surface evaporation and preventing surface run-off of rain water was not however adequate during prolonged periods

of drought, and these plots suffered severely on some occasions. Records for Block A are not presented owing to the very poor state of the trees, but the evidence obtained indicates that on such very shallow soils irrigation would be needed during drought periods at intervals of not more than ten days to maintain proper functioning of the trees. In the eastern states of U.S.A. such soils should be avoided for apple growing. The feasibility and possible value of irrigation under eastern orchard conditions are discussed.

SMALL FRUITS, VINES, NUTS.

41. RAWES, A. N. 634.7

Soft fruits. Notes on varieties under trial at Wisley.

Cherries and soft fruits: varieties and cultivation in 1935, 1935, pp. 133-7, Roy. hort. Soc., London, 6s.

The present position with regard to varieties of black and red currants, raspberries, strawberries, gooseberries, and blackberries under trial at Wisley is reviewed briefly.

42. CRANE, M. B. 634.71

Blackberries, hybrid berries, and autumn-fruiting raspberries.

Cherries and soft fruits: varieties and cultivation in 1935, 1935, pp. 121-8, bibl. 12, Roy. hort. Soc., London, 6s.

A brief description is given of some English native *Rubus* spp. which are prolific bearers of good sized fruits possessing the true blackberry flavour. With appropriate selection some of these might provide forms of value for the private garden and also perhaps for commercial purposes. Crosses between *Rubus rusticanus inermis* (diploid), which is free from prickles, and *R. thyrsiger* (tetraploid) have produced a number of tetraploids without prickles, which are much more vigorous than the diploid parent. There is reason to hope that further breeding will eliminate a tendency towards sterility shown by these hybrids. The cytological characters of the group of autumn-fruiting raspberries are outlined. In discussing the origin of some cultivated forms of *Rubus*, it is stated that the original account of the hybrid origin of the loganberry as the product of a cross between *R. ursinus* or *R. ursinus vitifolius* and a raspberry is probably correct.

43. BRIERLEY, W. G. 634.711-1.542

Studies of the response of the Latham raspberry to pruning treatment.

Tech. Bull. Minn. agric. Exp. Sta. 100, 1934, pp. 30, bibl. 16.*

Latham raspberry canes were subjected to spring pruning or "tipping", some to 15" and others to 36" and 60". Two major effects on growth responses were noted. Severe pruning tended to cause the production of a larger number of laterals at a given height in the cane, but to a less marked extent the mean length of these laterals tended to be less on the lower portions of severely pruned canes. These effects are probably related. The increases in numbers of laterals applied to new canes, twin laterals, and fruiting laterals. There are indications that severe pruning may lead to reduced vigour in subsequent growth especially at the base of the cane. Pruning effects may, however, probably be masked by other factors, environmental and cultural, which influence growth. A study of internal food substances in relation to pruning has shown that in dormant canes the percentage of common food materials, with the exception of amino-nitrogen which was constant, increased in direct relation to height, whereas the moisture percentage decreased. Severity of pruning appears to have had little influence upon these percentages, and its effect on them is therefore thought to have been simply a loss of stored foods in the parts of the cane removed. In seasonal trend the percentage of moisture in the fruiting cane declined slightly between the dormant stage and the beginning of bud development, then increased to a peak at blossoming time, after which it steadily declined until the death of the cane. The percentage of total sugars and of reducing sugars in both canes and laterals and

* Received 1936.

of total nitrogen declined throughout the season except for a minor rise following fruiting, thought to be associated with phloem breakdown. The percentage of "starch", i.e. the acid hydrolyzable carbohydrate other than sugars (except cellulose), showed a slight increase between the dormant period and bud development, but subsequently followed the same course as sugars. The percentage of amino-nitrogen was very small, but increased slightly in the canes up to the time of bud development and in laterals up to the time of blooming, after which in both cases a steady decline occurred.

44. BEAKBANE, A. B. 634.715 + 634.714

Blackberries and loganberries.

Cherries and soft fruits: varieties and cultivation in 1935, 1935, pp. 129-32, bibl. 2, Roy. hort. Soc., London, 6s.

160 loganberries were obtained in 1930 from a reliable commercial source. A detailed botanical study at East Malling has shown that only four of these plants appear to be identical with the original loganberry. More than half the total number of plants were "Phenomenal berry" and four were "Laxtonberry". This supports the contention that loganberries have from time to time been reproduced from seed and the variations so formed subsequently maintained by vegetative propagation. Confirmation that considerable mixing has occurred in loganberries was obtained by visits to commercial plantations. The distinguishing characters of the "Phenomenal berry", the "Laxtonberry", and the loganberry are described. A complex trial has been designed to compare clonal races, each vegetatively raised from a single parent, of true loganberry and "Phenomenal berry" and of distinctive loganberry variants of good performance. A study of cultivated blackberry varieties indicates a greater degree of trueness to type, but there is again sufficient variation to warrant classification and the selection of clonal races. Finally, seven varieties of blackberry and loganberry are listed as giving a good succession for garden purposes.

45. SELBY, H. 634.725

Commercial cultivation of the gooseberry.

Cherries and soft fruits: varieties and cultivation in 1935, 1935, pp. 138-47, Roy. hort. Soc., London, 6s.

A restriction in the demand for gooseberries during recent years has led to a general decline in production in most fruit growing districts of the country, and the outlook for future years is not hopeful. The reasons for this trend are explained. After describing the principal varieties an account is given of the cultivation of gooseberries. Among the points mentioned are propagation by cuttings, planting and spacing. The practice in some areas of interplanting gooseberries with strawberries under tree fruits is deprecated. The training of the bushes and intercultivation methods are described. Where no tree fruits are present it is possible to reduce hand-labour to a minimum during the first six or eight years by use of horse or mechanical implements. Experience in manuring suggests that supplying ample quantities of dung or organic substitutes such as shoddy or wool waste plus 3-5 cwt. sulphate of potash per acre annually will fulfil most requirements. Lime is also important. The more important pests and diseases and their control are discussed. Yields, picking and marketing costs, and prices for 1925 to 1934 are discussed. Tariffs appear to have appreciably reduced imports of green gooseberries in recent years. In general, however, selling prices are little above those of pre-war days, while labour charges, which comprise a large proportion of production costs, have risen considerably.

46. VINSON, R. 634.75

Growing healthy strawberries.

Cherries and soft fruits: varieties and cultivation in 1935, 1935, pp. 24-9, Roy. hort. Soc., London, 6s.

The author describes his own experiences in strawberry growing, and the methods he has adopted to maintain a healthy crop without undue expense. He touches on various aspects of soil, choice of stock, planting, cultivation, littering, manuring, diseases and pests, and sterilization.

In the discussion that followed, also printed here (pp. 30-51), Dr. Swarbrick deals at some length with soils for strawberry growing, times of planting, the benefits of "mass selection" of runners prior to planting, stocks and strains and the sources of runners, and the questions of varieties and pollination. Dr. Massee gives an account of the strawberry red spider, the strawberry tarsonemid mite, the yellow-edge (virus) disease and the delicate strawberry aphid, with descriptions of control measures in each case.

47. SCOVILLE, G. P. 634.8-1.56
An economic study of grape farms in eastern United States. Part 2. Harvesting and marketing.

Bull. Cornell agric. Exp. Sta. 628, 1935, pp. 46, bibl. in text.

Part 1, Production, was published in 1934 in bulletin 605 (*H.A.*, 1934, 4 : 4 : 546). In the present paper information is presented on harvesting and marketing practices, costs, and prices of the grape industry of areas in New York State, Pennsylvania, Michigan, and Arkansas. The economic survey covers a number of years, and the data collected appear to deal with every possible aspect. The text is accompanied by 41 tables.

48. REINECKE, V. 634.872-1.8
Die Kultur von Tafeltrauben in Südafrika. (The cultivation of table grapes in South Africa.)
Ernähr.-Pfl., 1935, 31 : 313-6.

Much the most important table grape centre in the Union is the Constantia district close to Capetown, where some 7,400 acres are devoted to this crop. Large quantities of grapes are sent to Europe each year. The author briefly discusses fertilizer trials made at Constantia with the Red Hanepot variety in 1928/9 and 1929/30, and notes that the sugar content in the NPK plots was higher than in the NP plots. He next describes his own trials on both types of soil at Constantia, namely a red brown, sandy loam and a grey sand. He tried the effect of giving different quantities of NPK in addition to or without lime and/or iron (FeSO_4). The normal potash application was approximately 600 lb. per acre of a $\text{N}=3 : \text{P}=12 : \text{K}=10$ mixture, while the heavy application was the same + 120 lb. K_2SO_4 per acre. The heavy potash dressings increased the sugar : acid ratio by 3-5% (e.g. in the series without iron from 15.04 : 1 to 18.47 : 1). Liming also tended to increase it. No definite effects could be ascribed to the addition of iron.

49. FAURE, J. L. 634.8
Sur l'arrachage des vignes. (Destruction of vines.)
Rev. Vitic. Paris, 1936, 84 : 102-13.

In view of the immense over-production of wine in France, 30 million hectolitres in excess in 1935, which has so lowered the price that numbers of growers are slowly being brought to ruin, the immediate destruction of at least 200,000 hectares of vines is advocated. This measure has already been approved by the government but has been postponed until 1937. The author is emphatic that this is too late. He discusses the percentage to be destroyed per hectare and the principle on which exemption is to be given and suggests that vineyards of under 3 hectares should not be touched (*a*) because of possible hardship to the proprietors and (*b*) because it would be practically impossible to convince the peasant owners of the necessity or propriety of sacrificing any portion of their vineyard for the common good. The author remarks that the suggestion would line the hedges with pitchforks and cause the family blunderbuss to explode from sheer horror! The respective proportion of vines to be destroyed in France and in Algeria is discussed. The delay in putting the order into effect is partly ascribed to opposition from Algeria. No exceptions should be made in the case of the "grands crus". The wines cannot be sold or exported in sufficient quantity and the destruction of a portion of the vines would at least reduce upkeep expenses.

50. DE CASTELLA, F. 634.836.72

***Phylloxera*-resistant vine stocks. (I, II and III.)**

J. Dep. Agric. Vict., 1935, 33 : 281-8, 303, 512-21, 567-74, 576.

The utilization of North American vine species and their hybrids, both natural and artificial, as *Phylloxera*-resistant stocks has given rise to an enormous choice of types, each of which demands special conditions for the most satisfactory results. In these articles a large number of stocks, many of which are little known in Australia, are described with particular reference to their soil and climatic requirements, their propagation and their affinities with and influence on the *vinifera* scions. This information, concisely presented, should be of value to all students of the stock-scion relationships of grapes.

51. RAVAZ, L. 634.8-1.541

Observations sur la greffe. (Notes on grafting.)

Progr. agric. vitic., 1936, 105 : 149-53.

The fact that large numbers of direct producing vines have to be eliminated has inspired the author to discuss methods of grafting when the new approved rootstocks are to be worked. If the rootstock is decapitated, cleft or whip and tongue grafting are the methods chiefly advocated, because both these methods result in a union which is strongly resistant to winds and necrosis. Methods of working the stock without first cutting it back are becoming popular. Shield budding is used largely in Italy, but complaints are made that subsequent breakages are frequent and that the union is complete only at the sides of the bud and not at the ends. The Mayorquin graft is also weak and needs support. The Cardillac graft is a form of side graft in which a scion bearing 1 or 2 buds is inserted in a slit made in the side of the trunk. The vine carries its current crop and is then cut back to the new scion. This graft is best placed on the north side of the tree in France, which will ensure the prevailing wind blowing on the dorsal side and so minimize risk of breakage. April-May is the best time for these operations. Causes of failure or retardation are found in a too vigorous flow of sap which keeps the graft too moist or a too vigorous foliation which tends to dry it up. A too vigorous shoot growth is even more detrimental, and to check the ill-effects of this the vine should be ringed 4-5 cm. above the point of insertion of the graft.

52. HACKBARTH, J., AND SCHERZ, W. 581.035.3

Versuche über Photoperiodismus. II. Das vegetative Wachstum verschiedener Rebensorten. (Photoperiodism investigations. II. The vegetative growth of various grape vines.)

Züchter, 1935, 7 : 305-21, bibl. 12.

Three clones each of American and European vine varieties, four F_1 clones of crosses between American and European varieties and one F_1 clone of a cross between two American varieties were tested for the influence exerted on them by normal or shortened daylight. All plants submitted to short day conditions showed decreased vegetative growth, increased root growth, better wood ripening and earlier conclusion of growing period than under normal conditions. Considerable differences were noticeable in the leaf form arising from the curtailment of daylight to 12 hours. Reaction to shortening the daylight is most noticeable in the American varieties and least so in the Europeans. The F_1 clones are in most respects intermediate. These investigations show that the American *Riparia* 72G, *Rupestris* 59G and *Solonis Trier* are short day plants, and that the European *Riesling*, *Gutedel* and *Silvaner* may be rather classed as neutral in this respect. The intermediate behaviour of the F_1 clone shows that the reaction intensity is inherited. The investigations are discussed in relation to their importance to breeding, ampelography and vine raising.

53. HEDIN, M. L. 634.8 : 581.144.2
 L'émission des racines adventives chez la vigne. (The emission of adventitious roots in the vine.)
C.R. Acad. Agric. Fr., 1935, 21 : 867-81, bibl. 13.

A certain number of American vine species, including *V. Berlandieri* which is an excellent rootstock on very diverse soils, have the disadvantage of rooting with difficulty from cuttings. The author briefly considers the work which has been done in the past to determine the reasons for this conduct and means of remedying it. He first considers rooting as affected by anatomy in different species. Next he deals with the internal conditions of the plant under the following headings:—(1) localization of adventitious roots at the lower level of the internodes, (2) the reaction of the internal milieu, (3) observations on the mineral composition of the roots, and (4) the effect of the starch content of the cutting. Finally, he turns to external conditions and considers the possible effects of the presence of various mineral salts in the soil.

54. VINET, M. E. 634.8-1.8
 Contribution à l'étude de l'alimentation minérale de la vigne. (A study of the mineral nutrition of the vine. The action of fertilizer on crop and quality.)
C.R. Acad. Agric. Fr., 1935, 21 : 30-41.

The author recounts the results of controlled experiments on vines at Savennières. The 6 plots compared each contain 5 rows, the number of vines in each row varying from 92 to 114. The two untreated control plots, Nos. 1 and 6, enclose 4 plots manured as follows, the same formulas having been applied to particular plots from 1928 to 1932 inclusive:—133.5 lb. sulphate of ammonia + 356 lb. superphosphate (per acre*) on all the four plots and in addition on plot 2 801 lb. potassium chloride (KCl), plot 3, 534 lb. KCl, plot 4, 556 lb. potassium sulphate (K_2SO_4) + 267 lb. KCl. No fertilizers at all have been given as from 1933. Graphs show the yearly production estimated in terms of weight of sugar in the grape crop and in the must. Under the conditions of the experiment the following conclusions can legitimately be drawn:—Fertilizers did not exert any perceptible influence on production (estimated in kg. of sugar per ha.) in the first year of application except for a very small effect when 801 lb. KCl was added. In the second their effect became definite without being very noticeable. These two determinations serve to demonstrate that, when applying fertilizer in the autumn, only by giving very large quantities can one be sure of getting an effect in the following year. It also confirms the theory that ordinary manuring has little effect on the fruiting of a vine in the year of application. In subsequent years effect on production is felt and to an increasing extent, and it continues even after application of fertilizers has stopped. In the case in point the application of 801 lb. KCl would only be considered a practical measure in the first year. The Cl anion in large amounts has acted as a brake on the action of the potash from the third year on. The SO_4 anion on the other hand always stimulates the action of the potash. This confirms the author's previous theories based on wood diagnosis experiments.† Initially the favourable effect on quality was more noticeable than that on quantity. In the course of the experiment this favourable effect persisted despite increase in crop due to manure. It has persisted for 2 years after the cessation of all manuring and there is no reason to doubt that it will continue to be felt in future years. This beneficial effect on quality can only arise, provided production does not rise above a certain limit. It increases when production tends to approximate to that of the controls and attains its height when the grapes are retained on the vines for the longest possible time prior to harvest. This observation justifies a rational use of fertilizers, in which potash in the sulphate form is dominant, for vines grown for high quality wine, especially for rich wines obtained by the use of over-ripe grapes.

* Amounts actually given in kg. per ha.

† See *H.A.*, 1933, 3 : 3 : 321-4 and 1934, 4 : 3 : 371.

55. VINET, M. E. 634.8-1.83
 Contribution à l'étude de l'alimentation minérale de la vigne. (*Vine manuring. Action of fertilizers on shoot growth in relation to its mineral composition and its capacity for production.*)
C. R. Acad. Agric. Fr., 1935, 21 : 911-9.

Observations were made at Savennières at the end of January in 1933, 1934 and 1935, on the shoot growth produced by vines which had received known manurial treatments in the years 1928 to 1933, [see Abs. 54 of this No.—ED.], after which no further manuring was done. The author sums up as follows:—In these experiments manuring had a definite effect on new wood growth, its composition and productivity. Without touching on the individual action of nitrogen and phosphoric acid, which we hope to deal with later, we can say that potassium had a remarkable effect on the growth of shoots and their capacity for production. The best shoots and those giving the best promise of fruit, as estimated by examination of the wood, were obtained by the use of large quantities of potash, there being nothing to choose in this respect between the sulphate and the chloride. Lack of potash in the manure produced after 5 years a physiological loss of balance tending to increase deficiency disorders and to decrease production and shoot growth as compared with vines on the complete manure plots. These determinations are important to the proper cultivation not only of table and wine grape varieties but also of varieties used as rootstocks.

56. SHOEMAKER, J. S. 634.8 : 581.192
 Sugar, acidity and juice color determination in grapes.
Bull. Ohio agric. Exp. Sta., 550, 1935, pp. 18, bibl. 6.

The sugar content, acidity, specific gravity, and the colour of the untreated juice of 120 grape varieties growing at Wooster, Ohio, were determined in 1933 and 1934. Samples, which consisted of three bunches of each variety picked when ripe enough for eating, were kept in airtight cartons at -20°C . until analysed. Results are tabulated and provide a measure of some of the factors that determine quality for dessert and wine purposes. For convenience the varieties are arranged in groups in comparison with the widely-grown variety Concord, and again according to the sugar-acid relation. On juice colour they are divided into ten groups.

57. ROSS, W. J. 634.8-1.542
 Viticulture. Notes on summer pruning.
Qd. agric. J., 1935, 44 : 489-93.

The objects of summer pruning vines include:—the direction of growth into the most useful channels, moderation of vigour, increased bearing and size of fruit, promotion of upright growth, the encouragement of shoot production to shade the bunches, or, where necessary, decreased shade. The operations by which these results may be obtained include disbudding and the removal of unwanted shoots, including suckers and watersprouts, pinching and topping, the removal of surface roots, and fruit thinning. These various methods of pruning and their effects, when done at different stages in the season's growth, are outlined. The removal of surface roots is advocated, because, if these are allowed to grow, they will form main roots, which are liable to injury during subsequent cultivation.

58. QUINN, D. G. 634.8-1.542.24
 Cincturing the Zante currant.
J. Dep. Agric. Vict., 1935, 33 : 614-16.

Cincturing is defined as "a special spring treatment applied solely to the Zante currant vine, in order to restrict the growth of the plant at flowering time, prevent abscission, and so induce a more even setting of the fruit than would otherwise be the case". When about two-thirds of the corollas have fallen from the flowers a girdle of rough bark is first removed from the main stem, and a complete ring, not more than one-twelfth of an inch wide is then cut in the green bark or bast down to the cambium. A double-bladed knife suitable for this purpose is described. Healing is encouraged by protecting the wound from wind and sun, and it is recommended that a

strip of waxed calico, about 1" wide, be wrapped around the ring. Where the operation is properly performed the gap will be completely bridged within 4-6 weeks and normal growth will then continue. It is essential to repeat the process annually, and if care is exercised the vines suffer no ill effects. On the other hand soil exhaustion, or adverse conditions associated with irrigation and drainage, or continuous faulty cincturing have been found to lead to loss of vigour after a number of years, and under such conditions, unless remedial treatments are applied, further cincturing may have an excessively devitalizing effect.

59. MARTINEZ ALVAREZ, M. 634.54
 El avellano. Su cultivo e importancia. (**Cultivation and commercial importance of hazel nuts (in Spain).**)
Econ. Tecn. agric. Madrid, 1935, 4 : 296-9.

The hazel nut is grown in most of the provinces of Spain, the total area under its cultivation being about 11,275 hectares (i.e. more than 27,000 acres). The most valuable varieties are Asturiana noted for its delicate flavour, de Mallorca and Negreta de la Selva, the last named being in greatest demand for its keeping qualities which extend over years while the others last only a few months. The principal centre for this nut is the province of Tarragona. The most suitable soils are light, cool and deep, well aerated and with a fair supply of moisture. Marsh or clay soils are prejudicial. Propagation is by seed, suckers, layers or shield budding. Plants from suckers are ready for their permanent positions in about 3 years. Seed grown plants are raised chiefly for rootstocks and only the largest, unblemished nuts are selected. They are planted out after 3 years and then budded with the chosen variety. If budding takes place before transplanting, it is done when the stock is of finger-thickness. Planting distances are 8 metres between and 4-5 metres in the rows. The planting holes are 1 metre across and 85 cm. deep. A layer of stones and branches to a depth of 30 cm. is placed at the bottom of the hole, above that a 10 cm. layer of soil rich in humus, then the plant, which has been lifted from the nursery with as little root damage as possible, another layer of the humus rich soil and manure and finally the soil excavated from the hole is filled in. Soil cultivation should be by hand hoeing owing to the shallow rooting nature of the hazel. An annual pruning is given in November and December. The object is to keep the centre of the tree open, bearing in mind that the flowers are produced on the wood of the previous year. In the matter of manures the formula per tree usually recommended is calcium superphosphate 2.75 lb., sulphate or chloride of potash 1.5 lb. and nitrate of soda 2.75 lb. At harvest the nut clusters are picked by hand and placed in layers 25 cm. deep under cover until they dry sufficiently to become detached from the involucre. To retain their flavour until sold they are subsequently stratified in sand or dry sawdust. The paper ends with a mention of certain pests and diseases, a note of the commercial uses to which the nut can be put, and a tabulation of the number of trees, yields and value of crop in the principal nut-growing provinces of Spain.

PLANT PROTECTION OF DECIDUOUS FRUITS.

60. SCHWECHTEN, A. 634.1/2-1.541.11-2.111
 Untersuchungen über die Kältefestigkeit von Obstunterlagen. (**Investigations on resistance to cold in fruit rootstocks.**)*
Gartenbauwiss., 1935, 9 : 575-616, bibl. 57.

The aim of these tests is to determine the relative cold resistance of certain clonal fruit rootstocks and to work out a method of testing this. To achieve this first the direct influence of cold was tested, and then the efficacy of chemical and physical investigations on the expressed sap and on the dry matter was examined. In the 3 winters 1932-5 the following plants were tested:—

* Full translation available.

2,585 plants from 6 apple clones, 955 plants from 9 quince clones, 300 plants from 6 plum clones, 4,438 apple seedlings, 330 pear seedlings. An apparatus involving the use of dry ice was set up and used for testing the effect of cold on the plants. The resulting damage is described. It is shown that variability in cold resistance is very small within a clone and very large in seedlings. To achieve useful results from cold resistance tests with clones it is essential that they should have previously received exactly the same treatment. The resistance capacity of the clones of any one origin remains relatively the same whatever the cultural conditions have been. Clones coming from different places should not be compared without a preliminary test selection. Damage depends on temperature conditions and length of exposure. The following differences were established "1" signifying greatest cold resistance: 1. East Malling apple clone XVI, 2. E.M. IX, 3. E.M. IV, 4. E.M. V, 5. E.M. II, 6. E.M. XI, 1. East Malling quince clone A, 2. quince S,* 3. E.M. quince C. As regards plum and quince clones tested during one winter only these can be placed in order of cold resistance as follows:—Mussel, Hüttner 3, Croosjes blau, Croosjes gelb, Brussels, Ackermans, and quinces (1-year-old) Pillnitz 3, Pillnitz 2, Pillnitz 1, Pillnitz 5, Lescowace, Angers and East Malling quince C. The attempt to investigate cold resistance by indirect determinations did not result in any clear correlation being established. Results are noted in connexion with the existing published literature on the subject. Suggestions are made for a practical method of testing cold resistance by observation of artificially induced cold effects.

61. ZWEEDE, A. K.

632.111 : 634.1/8

Over nachtvorst en nachtvorstbestrijding in de Nederlandsche fruitteelt.

(Night frosts and their control in Dutch orchards.)

Fruitteelt, 1934, 24 : 161-98, bibl. 24.

This is a very full account of the whole problem as it affects Dutch fruit growing. As in England so in Holland radiation frosts are the chief danger. The suggested methods of control which are fully discussed are:—(1) Mixing the air. This has been tried successfully by means of motor driven air propellers in America and Austria, but is not economic. (2) Attempts to increase counter radiation of the atmosphere by burning soot-producing materials, or the production of chemical fogs. Mention is made of vast experiments in the Moselle vineyards which have proved the feasibility of covering large areas with smoke clouds and raising the temperature some 2°C. (3) Screening. (4) Heating by means of orchard heaters, burning coal briquettes or oil, the results being due to heat and to the counter radiation effects of the smoke and water vapour produced. Heaters may be divided into two types, (a) those in the form of a pail without a chimney, and (b) chimneyed heaters. A great deal depends on the chimney and the facility for draught regulation. It is considered that heaters must conform to the following demands:—(1) contain enough fuel to last the night, (2) be capable of regulation so as to give the greatest heat just before sunrise—i.e. when fuel is nearly exhausted, (3) be capable of burning any ordinary fuel without much soot production or any residue, (4) be impenetrable to rain, (5) give out heat close to ground without unnecessarily warming ground, (6) be easily lighted and managed, (7) be able to be lighted with the regulatory openings closed, (8) be easily extinguished, (9) be refillable and cleanable without removal of chimney or lid, (10) have reservoirs with bottoms not damaged by burning, (11) allow no condensation of oil on chimney or lid, (12) be low priced, (13) be subject to small and slow depreciation only, (14) be easily cleaned and stored. It is suggested that the most suitable fuel is Diesel machine oil of 27° Baumé or of petroleum base 38°-40° Baumé. Its sulphur content should be less than 0.75%, carbon residue less than 0.5%, and freezing point below -10°C. Details of costs of heating from America are given. Tests were made of the resistance of different fruit trees to different temperatures at different stages of development, namely closed bud, full bloom and small green fruit stage, and results are tabulated. The second half of the paper is devoted to an account of the observations made in the spring of 1934 at Wageningen on frost control, and the use of heaters including every incident in their handling, the difficulties encountered and the measures taken to ensure the most

* Unknown quince from Schindler of Pillnitz.

efficacious results. Notes are given on warning signs and signals of the imminence of dangerous temperatures, and a final table gives details of the meteorological phenomena observed on a night of late frost, i.e. 17th-18th May, 1934.

62. LIJSTEN, R.
Nachtvorsten. (**Night frosts.**)
Fruittel., 1935, 25 : 132-41.

632.111 : 634.1/7

In a general discussion of the factors governing frost damage it is noted that normally in Holland the closer the fruit is to the ground, the greater is the liability to frost damage, from which it follows that standard fruit trees are less liable to it than dwarfs and dwarfs than strawberries. That this rule is not of universal application was demonstrated in 1935. It is considered that frost exceeding 3°C. (= 5.4°F. or temperature of 26.6°F.), is likely to cause damage. Experiments in 1935 at the Utrecht experiment farm on $\frac{1}{2}$ hectare (1.235 acres) of dwarf pears planted in 1919 showed the possibility of keeping the heated area at a temperature round about zero as against -3°C. registered outside the heated area. 100 stoves were used, being spaced at intervals of 5 m. on the outside of the rectangle and more sparsely in the interior. On the first night the stoves burned very fiercely and had to be refilled after 3 hours. In the 5 hours of burning each heater consumed 8 litres of oil (= 1.75 gallons). On the second night the regulators were shut down more so that the temperature in the morning actually fell to just below 0°C., to rise again on opening the valves. The average consumption on the second night was 6.5 litres (1.42 gallons). On both nights the stoves were lighted at midnight and extinguished at 5 a.m. The question of to heat or not to heat is considered in the light of meteorological data between 1922 and 1935, and the author comes down mildly in favour of heating, mainly on the grounds that good fruit farms should be able to guarantee a reasonable crop every year and that the change over from standard to dwarf trees of recent years in Holland makes the danger of loss by frost damage greater. With regard to the inconvenience of refilling stoves during the night, it is suggested that a more practical way of overcoming it than increasing the size of the reservoirs is to increase the number of stoves, part of which can be kept in reserve for lighting when and if required. In these experiments damage was caused in certain cases to trees by the flaming up of certain of the stoves probably owing to rain water having got into the reservoirs. Hence the necessity for preventing its entry is stressed. The article concludes with tables showing (1) the serious spring frosts experienced between 1922 and 1935 and the dates of flowering of apples and pears in the corresponding years, and (2) the damage done to pear and apple blossom on the Utrecht experiment farm by 3°C. of frost (temperature of 26.6°F.) on the night of 1st and 2nd May, 1935.

63. GESLIN, M. H.
Observations sur les gelées de printemps et les moyens de protection. (**Spring frosts and protection against them.**)
C.R. Acad. Agric. Fr., 1935, 21 : 1137-42.

634.1/8-2.111

A consideration of frosts in past years leads the author to conclude that in the Paris neighbourhood the essential is to prevent a spring frost, i.e. in April or May, according to forwardness of the season, from exceeding 4.5° to 5.4° Fahrenheit (temperature of 27.5°-26.6°F.). He reviews the results obtained by different methods. The cloud producing machines and substances he dismisses as being incapable of increasing the temperature by more than 1.8° to 2.7°F. and therefore of being a serious protection when used alone against a severe frost. He thinks, however, that as a subsidiary control measure to complete the action of heaters or to prevent a too sudden thaw they have much to commend them. The best direct heaters of the air he considers to be gas oil burners, having the great advantage of quick action, immediate extinction, absence of residue and minimum labour costs. The cost of the fuel is, however, prohibitive in France. He has himself used with considerable success the conglomerate artificial coal—known in France as "boulets". It is very homogeneous, burns very regularly and leaves practically no residue except a very fine ash, while its high density as compared with coke allows the use of

smaller braziers. He has used for the purpose old oil drums 40 cm. high \times 30 cm. across with holes pierced as required. For a useful duration of fire for 3 hours one must count on 12 kg. (26½ lb.) of fuel per brazier, this costing 2 fr. The fire can be made to last up to 5 hours by blocking out some of the draught. It was found possible when working on an area of .37 acres using 30 braziers (i.e. 81 to the acre) to raise the temperature 3.6°-4.5°F. It is considered that working with a proportionately equal number of braziers on a larger area it would be possible to raise the temperature by 5.4°-6.3°F. or the equivalent of gas oil. A primary essential is the determination of the danger point for the different orchard fruits. Again, unless the cost of any control measures are less than the returns which the saved fruit would bring in, they cannot be recommended.

64. ANON. 632.111.35

Solid fuel orchard heaters. Successful tests in Victoria.

Fruit World, Melbourne, 1935, 36 : 8 : 13.

The "Protector" solid fuel orchard heater has been designed and patented by two Victorian growers, Messrs. J. A. Egan and E. A. Williams. It is described as smaller than the ordinary citrus grove heater, and has been developed specially for use in vineyards. The fuel is brown coal briquettes, and a single charge of 15 lb. will burn for 4 hours uncontrolled, and a much longer period when controlled by damper operation. One man can fire 50 heaters, covering an acre, in 12 minutes. The cost of firing 1 acre for 4 hours including fuel, kindlers and depreciation of heaters is approx. £1. Two tests of the heater are described in this article. The first was carried out on an acre of mandarins, using 49 heaters, each fueled with 25 lb. briquettes at 4½d. per heater, a smoke screen being created by closing down the dampers. Firing was done at 1.30 a.m. and the heaters were out by about 6 a.m. Thermometer records show a difference of up to 8°F. obtained by using the burners. The second test was conducted in 3¼ acres of vineyards. Two men lit 187 heaters in 30 minutes. Despite a drift of cold air from an adjacent low-lying area a temperature rise up to 4.25°F. was recorded.

65. ANDERSON, P. O. 632.183

Planting the standard windbreak.

Spec. Bull. Minnesota agric. extension Division, 168, 1935, pp. 8.

A standard windbreak project is at present being promoted in Minnesota. The object is to supply adequate protection to the farmstead, provide fuel, repair materials, fence posts, and in due course timber which should be easy to market locally. The main windbreak is 80 feet wide, planted at least 100 feet from the farmstead, and consists of 8 rows of trees. The intervening space between the buildings and windbreak is suitable for an orchard. Outside the windbreak an open area, 40-60 feet wide, on which summer crops or pasture may be grown, acts as a snow-trap, and outside this again two rows of shrub-like trees are planted as a snow-catch. The project thus calls for very extensive planting, and this paper explains how this should be done, what trees should be grown in each row, and how they should subsequently be cared for.

66. OTERO, J. I., AND COOK, M. T. 632.8

First supplement to partial bibliography of virus diseases of plants.

J. agric. Univ. Puerto Rico, 1935, 19 : 129-313.

Approximately the first 100 pages of this supplement consist of additions to the original bibliography (*Ibidem*, 1934, 18 : 5-410). This was abstracted in *H.A.*, 1935, 5 : 3 : 388, where it will be noted that a criticism was levelled against the omission of any form of classification of the particular plants and their specific diseases. This omission has been rectified in this publication by the inclusion of a subject index for the main bibliography. An author index and errata are likewise appended, as well as indexes applying to the present supplement. It appears to be the policy of the authors to publish further supplements from time to time, and to supply where necessary corrections to existing bibliographies, and they, therefore, welcome any advice and assistance which investigators in this field may be able to offer.

67. COOK, M. T. 632.8
 (1) **Host index of virus diseases of plants.** (2) **Index of the vectors of virus diseases of plants.**

J. agric. Univ. Puerto Rico, 1935, 19 : 315-406, 407-20.

It is not claimed that either of these indexes are complete or always accurate, but they appear to cover the ground very fully, and taken in conjunction with the "partial bibliography of virus disease of plants" assembled by Otero and Cook* in 1934 they should prove of considerable assistance to students of virus diseases throughout the world.

68. SMITH, K. M. 632.8 : 635.9
The virus diseases of glasshouse and garden plants.

Sci. Hort., 1936, 4 : 126-40, bibl. 8.

The symptoms of the following viruses which cause disease are described in a large number of garden ornamentals, of different species and genus:—Tomato spotted wilt, cucumber mosaic, cabbage mosaic. Other diseases noted are the mosaic or stripe disease of bulbous plants, the virus which causes "breaking" in tulips, virus diseases of lilies, namely mosaic and rosette, and leaf curl of pelargoniums. The general control measures advocated are:—avoid the indiscriminate mixing of different kinds of flowering plants with other crops in the same glasshouse or frame. Keep glasshouses as free as possible of insects by routine fumigation or spraying. Clean and fumigate tomato houses before introducing other plants, especially arum lilies. Remove any plants showing unusual markings on leaves or flowers.

69. AINSWORTH, G. C. 634.37-2.8
Fig mosaic.

J. roy. hort. Soc., 1935, 60 : 532-3.

The symptoms of fig mosaic as shown in a fig tree of the variety White Ischia growing under glass at Cheshunt are described. The method by which the virus is transmitted in nature is unknown. The disease has been recorded in many parts of the world, but nowhere appears to do serious damage. No definite control measures can be recommended, but, as experiments in California have shown that it can be transmitted by grafting and in cuttings, it is suggested that care should be taken to avoid propagating stocks from trees showing the slightest signs of infection.

70. FAUVRE, J. 634.25-2.4/7
La lutte contre les ennemis du pêcher dans la vallée du Rhone. (Control of peach pests and diseases in the Rhone valley.)

Progr. agric. vitic., 1936, 105 : 109-12, 139-43, 157-62.

This series of articles deals with all the pests, fungus and physiological diseases which attack the peach in the Rhone valley. It is still continuing. Valuable notes are given on the best means of control.

71. HARRIS, R. V. 634.711-2.4/7
Growing healthy raspberries—the control of diseases and pests.

Cherries and soft fruits : varieties and cultivation in 1935, 1935, pp. 95-107, Roy. hort. Soc., London, 6s.

This paper is limited to the pathological aspects of growing healthy raspberries. The major diseases and pests are described, and divided into four groups based on the form of injury caused. They are as follows:—A. Diseases which cause a die-back of canes. (1) Blue stripe wilt, *Verticillium Dahliae* Kleb. (2) Dwarf-lateral scorch, black root-rot, and crown-rot, induced solely by unfavourable soil and weather conditions. B. Diseases and pests which inhibit the normal

* Otero, J. I., and Cook, M. T. *J. agric. Univ. Puerto Rico*, 1934, 18 : 5-410, *H.A.*, 1935, 5 : 3 : 388.

development of one or more fruiting laterals. (1) Cane-spot, *Elsinoë veneta*. (2) Spur-blight, *Didymella applanata*. (3) Raspberry moth or red bud maggot, *Lampronia rubiella* Bjerk. C. Diseases and pests which directly attack the berries. (1) The raspberry beetle, *Byturus tomentosus* Fabr. (2) Cane-spot fungus attacking the berries directly. D. Diseases which sap the normal vigour and productivity of stools generally. (1) Raspberry mosaic disease. (2) Nutritional disorder in relation to mosaic, including leaf-scorch and the effect of manuring on mosaic stools. Control measures are described in detail for each disease and pest. At the present time the proper application of certain routine measures of control is essential for the growing of healthy Lloyd George raspberries. The problems in the breeding of new varieties resistant to the more serious diseases are outlined. The general discussion on this paper is also reported.

72. KÜTHE, K. 632.42: 634.11
Zur Infektion und Kultur des Apfelschorfes, *Venturia inaequalis* (Cooke)
Aderhold. (**The infection and culture of apple scab.**)
Gartenbauwiss., 1935, 9 : 405-20, bibl. 7.

Proof was afforded of the long-held belief that scab attacks are dependent on rain by a series of exposures of previously isolated apple seedlings to scab infection in the open between April 10th and November 1st. Artificial infection with single spore cultures was also successfully carried out on small trees in the greenhouse under proper, controlled conditions. Of 38 single spore cultures from one spot of scab 36 were identical, one was very different morphologically and physiologically, and one could not be classified. The mycelium of some of the single spore cultures continues to grow at a temperature of 28° C. (82·4° F.), that of others does not. On apple juice agar at a temperature of 5° C. (41° F.) the spores are larger than at 20° C. (68° F.), but the mycelial growth is just the opposite. In yeast medium acidified with tartaric acid the spores are somewhat broader and the variation is smaller than when the medium is neutral.

73. HALL, J. W. 634.11-2.42
Special sulphur dust versus lime-sulphur for apple scab control.
Scot. J. Agric., 1935, 18 : 254-9, bibl. 4.

Both liquid lime-sulphur and a special sulphur dust appear to have reduced the incidence of apple scab in three seasons on a number of varieties situated in two orchards in Scotland. Scab in the control plots has also been reduced in each successive year, probably through eliminating sources of infection in the treated plots. Two pre-blossom treatments of spray (1 in 29) and dust, 2-3 post-blossom spray applications (1 in 99), and a greater number of post-blossom dust applications were made. Dusting would appear to have been rather less expensive a process than spraying, there being a saving in time, labour, and cost of material. The observation is noted that neither material appeared to exert any appreciable control over red spider, which conflicts with evidence obtained in England. The trials are being continued.

74. WILLISON, R. S., AND CHAMBERLAIN, G. C. 632.42 : 634.25
Studies in fruit diseases. VIII. Preventing peach canker.
Circ. Canad. Dep. Agric. 92 (Publ. 480), 1935, pp. 8.

Peach canker, caused by the fungus *Valsa cincta* Fr., is widespread in Ontario, attacking all the more important varieties. Infection takes place through dead areas and wounds, and occurs most readily shortly before, and for some time after leaf fall. The cankers formed are usually perennial. Measures which help to control the disease are as follows:—Pruning should never be done in the autumn, but should be delayed until at least mid-January or preferably till March or April, because infection becomes less frequent as the dormant season progresses, and, moreover, healing processes are started more rapidly. Pruning should further be restricted to the minimum of cuts necessary, and then should be made so as to avoid leaving stubs of any kind. Dead wood should be removed at the same time, and any wood that dies subsequently cut out

not later than the end of June. All prunings should be collected and burnt. The early and proper maturity of the trees in the autumn is important, and manuring and cultivation should be controlled to avoid prolonging growth unnecessarily. It is recommended in this connexion that the season of open cultivation should cease in the first week of July. Lesions on twigs and spurs produced by brown rot frequently become infected by *V. cincla*, and summer spraying and the destruction of mummied and rotting fruits to control the former disease will indirectly assist in controlling canker. Where cankers form on the trunks or main branches, especially on young trees, they should be cut out and cleaned as far as possible in the spring, and then immediately disinfected with 1 : 500 corrosive sublimate (1 oz. to 3 gallons water), being covered finally with a non-injurious protective material such as white lead paint, mixed with a little boiled linseed oil but free from turpentine, or any approved asphalt preparation.

75. CATION, D. 634.25-2.42

One spray controls peach leaf-curl.

Quart. Bull. Mich. agric. Exp. Sta., 1935, 18 : 86-8.

Leaf-curl, caused by *Taphrina deformans*, is the most prevalent and destructive fungus disease of peach trees in Michigan. Symptoms of attack are described. The disease may be controlled completely by one spray application in the autumn or in the spring before the buds swell. Home-made bordeaux mixture 8-8-100 may be used for either, but the standard local practice is an early spring application of liquid lime-sulphur at 5 in 100 or, if San José scale is also to be controlled, 12½ in 100. Lime-sulphur used in the autumn may injure semi-matured wood.

76. ANTHONY, M. V. 632.951.22

Apparatus for dusting sulfur on plants in controlled amounts.

Science, 1935, 81 : 364.

The apparatus is described with the aid of a diagram. It is adapted for use in laboratory tests where it is required to deliver quantitatively small amounts of sulphur to the under surface of leaves of plants growing in pots. The part consisting of a dust gun can also be easily adapted into a useful hand duster.

77. ALCOCK, N. L., AND HOWELLS, D. V. 634.75-2.411.2

The *Phytophthora* disease of strawberry. I. Pathological investigations.

II (by Howells), The *Phytophthora* disease in the field.

Sci. Hort., 1936, 4 : 52-8, bibl. 4.

The first author traces the life of the fungus and shows that ample proof is available of the organism being a pathogen both from laboratory tests and on the evidence of infection in the field resulting from introductions from diseased areas. Chemical treatment of the soil is not entirely successful and the remedy would seem to lie in breeding. A certain rogue and some strains of one strawberry variety have been found to be resistant. In part II the second author gives instances of the occurrence of the disease in the field and records its spread from its first recorded outbreak in Scotland in 1921. It is known to the grower as the "red core" disease. Most of the 1,500 acres formerly devoted to strawberry production in Lanarkshire are now perforce under agricultural cultivation.

78. FAES, H., AND STAEHELIN, H. 634.8-2.42

Le coître de la vigne (*Coniothyrium diplodiella*). (White rot of vines.)

Reprinted from *Progr. agric. vitic.*, 1935, pp. 24.

The authors give a full account of the manner of attack by this fungus and make suggestions with regard to its control. As yet, however, control measures have had only indifferent success. It is here suggested that the application after a fall of hail of a mixed powder containing substances which are drying, alkaline and anticyptogamic should be effective. A list of these is given.

79. ARNAUD, G., AND BARTHELET, J. 634.972.4-2.42
 La "pourriture noire" des châtaignes ou nérume. *Sclerotinia pseudo-tuberosa*. (**Black rot of chestnuts.**)
C.R. Acad. Agric. Fr., 1936, 22 : 48-51.

This disease which also attacks oak acorns and beech nuts has in chestnut as yet only been found in the fruits. Exteriorly the diseased fruits appear normal. At the time of normal fruit fall, i.e. October, no cases were found in the chestnuts gathered from chestnut trees at Versailles in 1935, but 2 months later, the weather having been warm and wet, a collection of those lying on the ground disclosed some 30% infection. In default of exact knowledge this fact suggests that the best control lies in gathering the chestnuts at their normal fruit fall and then keeping them in a cold wet place. Testing by floating discloses only those in which the disease has developed considerably, while the nuts which are diseased but have only lost a little weight are still undisclosed.

80. KADOW, K. J., AND ANDERSON, H. W. 634.25-2.952
The rôle of zinc sulphate in peach sprays.
Bull. Ill. agric. Exp. Sta. 414, 1935, pp. 207-55, bibl. 75.

This paper is divided into four main parts. (1) *Zinc sulphate as a fungicide*. Field tests with zinc sulphate-lime for controlling peach scab and laboratory tests with brown rot indicate that $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ is at best only a weak fungicide, much inferior to sulphur, and showing no advantages when added to lead arsenate-lime over this mixture alone. (2) *Zinc sulphate as a bactericide*. Field tests and observations and laboratory experiments on the effect of $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ on *Phytophthora Pruni* (E.F.S.) Bergey *et al*, causing peach bacterial spot disease, indicate very poor bactericidal properties. (3) *Effect of zinc on growth of peach trees*. Zinc is always present in the ash of normal peach tissue. Zinc sulphate applied to leaves as a spray with lime or with lead and lime appeared to effect slight penetration. Applied at a rate of 3 p.p.m. zinc increased the green weight of trees growing in purified quartz sand, but had no effect on seedlings growing in a silt loam soil. This supports the belief that zinc soil or spray applications would stimulate growth in soils deficient in soluble zinc. The exact effect of zinc and the extent to which it is necessary for peach trees is unknown, but, however it is applied, it does not have a measurable effect on pigment formation. Trees sprayed with zinc sulphate compared with others sprayed with lead arsenate-lime tend to have darker green foliage, but this is due to a decrease in the pigment content of the lead-lime sprayed trees. (4) *Zinc sulphate as a corrective for peach spray injury*. Data collected over a period of three years indicate that the addition of zinc sulphate to lead arsenate-lime sprays practically eliminates arsenical injury. In fact under Illinois conditions it is entirely unsafe to omit zinc sulphate from this spray mixture. Its action appears to lie mainly in preventing the formation of calcium carbonate, which causes large increases in water-soluble arsenic. Any arsenic acid formed is also probably immediately precipitated as insoluble zinc arsenate. The evidence to date indicates that the amount of zinc sulphate required in the mixture is 6 lb. to 6 lb. hydrated lime, 3 lb. acid lead arsenate in 100 gallons water.

81. TATTERSFIELD, F., AND MARTIN, J. T. 632.951.1 : 581.192
The problem of the evaluation of rotenone-containing plants. 1. *Derris elliptica* and *Derris malaccensis*.
Ann. appl. Biol., 1935, 22 : 578-605, bibl. 11.

1. Seven samples of *Derris* root have been examined chemically, and the following determinations carried out : rotenone (crude and recrystallized) ether extract, methoxyl content, and dehydro compounds. The importance of using standard methods of analysis is stressed. 2. Insecticide tests have been carried out and comparisons made between pairs of samples tested on the same day. 3. When comparisons were made between pairs belonging to *different* species of *Derris*, the determinations of rotenone by the present methods, ether extract or methoxyl content, did not express accurately the relative insecticidal potencies of the pairs of samples. When comparisons were made between pairs of the *same* species, all these determinations appeared to

give a closer measure of their relative activities. 4. In our samples, the estimation of the dehydro compounds, or of rotenone plus the dehydro compounds in the resin, gave a better assessment of the relative potencies than the other determinations, whether comparisons were made between samples of the same, or of different species. Further work is, however, needed, [Authors' summary.]

82. EVANS, A. C., AND MARTIN, H. 632.95
The incorporation of direct with protective insecticides and fungicides. I. The laboratory evaluation of water-soluble wetting agents as constituents of combined washes.
J. Pomol., 1935, 13 : 261-92, bibl. 33.

The great increase in the number of wetting agents in recent years has made it essential that simple methods of evaluation should be evolved. The authors summarize their highly technical article as follows:—(1) For the purpose of selecting for field use the most promising of the numerous wetting-out agents, detergents and other products now available as "spreaders" in combined washes, a laboratory method for the determination of spray retention is described. (2) This method has been applied to the evaluation of the wetting and spreading properties of aqueous solutions of these materials and to the examination of the suitability of the physical characteristics of area of spread and contact angles upon standard surfaces and of surface tension as criteria for the evaluation of wetting and spreading properties. (3) The detergents, wetting-out agents and other materials of possible value as "spreaders" are classified on a structural basis and analytical data of those selected for the preliminary trials are recorded. (4) Wetting properties are defined by the ability of the liquid to form a persistent liquid-solid interface when excess of liquid is drained from the surface. A high correlation is shown between the wetting properties and the receding contact angle of the spray. Perfect wetting results when this angle is zero. (5) Spreading properties are defined by the ability of the liquid to form a liquid-solid interface solely by surface activity over the plane surface of a solid, and are, for the time being, distinguished from penetrating properties which determine the creep of the liquid through a porous solid. Spreading properties may therefore be assessed by the estimation of the area of spread. (6) The maximum amount of spray initially retained upon the standard plane surface held rigidly at right angles to the direction of the spray, is determined by both the wetting and spreading properties of the spray for that surface and shows a marked decrease with increase of wetting and spreading ability. (7) The area of spread is determined by the advancing contact angle, but in solutions of similar advancing contact angle examined is greater with spreaders of long-chain structure. (8) The receding and advancing contact angles of the solutions examined exhibit a high degree of correlation, with the exception of saponin solutions. There is accordingly justification for the use of the equilibrium contact angle but, for reasons given, it is considered advantageous to regard the advancing and receding angles as distinct entities. (9) The various physical properties examined, namely, spray retention, area of spread, contact angles and surface tension, all arrange the materials tested in the same rough general order of activity. Except in the case of the correlations mentioned above, the determination of any one characteristic is insufficient to give a general assessment of wetting and spreading properties. The results obtained suggest, however, that with materials of similar molecular structure it may be possible to deduce generalizations upon behaviour as a spray spreader and wetter from a limited number of laboratory-determined characteristics.

83. MENZEL, K. C. 632.952.2
 Untersuchungen der schädigenden Wirkungen kupferhaltigen Spritzmitteln.
(Investigations on the harmful effects of copper sprays.)
Angew. Bot., 1935, 17 : 225-53, bibl. 38.

The author's experiments which he here describes largely concern apples. Symptoms of copper spray damage are the same in all plants investigated. The higher the osmotic value of a plant is, the less is its susceptibility to copper spray damage. Since manuring alters the osmotic value of a plant and generally speaking raises it, it also affects its resistance to copper spray

damage: manured plants are hence less susceptible than unmanured. Along with its osmotic strength the leaf structure of a plant plays a rôle in determining its susceptibility. Bearing and non-bearing trees of the same fruit variety show a susceptibility, the degree of which can be correlated with differences in their leaf structure. Non-bearing trees are more susceptible than bearing trees. Leaves copper sprayed wilt more slowly than non-sprayed leaves. They also transpire less than unsprayed. The green blotches which occur on copper sprayed leaves are more difficult to dissolve than the chlorophyll of the unsprayed leaves. The effects are the same whether copper sulphate, chloride or acetate are used. That the intensity of the burning may differ according to the compounds is probable. [Author's summary.]

84. RECK, G. F., AND OTHERS. 632.951.8

Testing mineral oil emulsions for the control of orchard pests. [Georgian-English summary.]

Proceedings of the zonal pomological station state farm trust, Peoples' Commissariat of Agriculture, Soviet Socialist Republic of Georgia, 1935, pp. 24, bibl. 11.

Laboratory, breeding house and orchard experiments with machine oil emulsions of different concentration indicated that 0.5% oil concentration gave 100% kill of codlin moth eggs (*Carpocapsa pomonella* L.), and that 0.25-0.5% gave 100% kill of the eggs of *Hyponomeuta melinellus* Zell. The larvae of the latter require somewhat higher concentrations. A 2% oil concentration produced only up to 57% mortality in larvae, nymphs, and adults of the pear bug (*Stephanitis pisi* F.), but emulsions ranging from 0.5-2% gave 93-100% kill of larvae and nymphs of the pear psylla (*Psylla* sp.). Aphids, such as woolly aphid, green apple aphid, and others showed mortalities up to 50% from oil applications. In no case did the oils cause any injury to leaves or fruits. [From authors' summary.]

85. TAYLOR, G. C. 632.94

Removal of spray material accumulated in the pipes of stationary spraying systems.

Orchard N.Z., 1935, 8 : 11 : 11-2.

Accumulation of spray materials, usually taking the form of large particles of sulphur, lead sulphides, calcium carbonate, and calcium arsenate may increase frictional resistance in the pipes of some stationary spraying systems to such an extent as to cause excessive pressure loss. Of materials tested as cleaning agents commercial hydrochloric acid (HCl), 1 part to 19 parts water, proved to be the most satisfactory. The pipes are filled with the acid solution, the pump being washed out with water as soon as filling is completed. After about 30 minutes the pipes should be emptied, and also washed out with water. A second treatment may be necessary where the deposition has been allowed to become severe. It is estimated that it will take about 2 gallons HCl, that is nearly 40 gallons of the solution, to fill the system of a 10-acre block piped with 1" and $\frac{3}{4}$ " mains and $\frac{1}{2}$ " laterals.

86. FULLER, G. D., AND LEADBEATER, M. R. 632.951.8

Some effects of fuel oil on plants.

Plant Physiol., 1935, 10 : 817-20, bibl. 5.

The fuel oil used in the experiments described here is known commercially as 3236 Baumé gravity gas oil. It consists principally of saturated hydrocarbons, and has a viscosity of about 55 seconds Saybolt. It is similar to the "medium oils" used in spraying. Reactions of tomatoes and young peach trees growing in pots to applications of the oil in different amounts to the surface soil are reported. The results indicate that commercial fuel oil has a harmful effect on plants when brought in contact with their roots through the soil, and the effect becomes fatal when the quantity is raised above the critical point for a particular species. With an application of 2% or more by volume of the soil content of the pots all peaches died within 45 days. With tomatoes an application of 3% or more caused death within 42 days, but with an application of 2% half the plants were still alive after 51 days. The prevention of contact

between the oil and the stems at the soil surface produced no difference in the effect, thus suggesting that contact does not seem to be the primary cause of death. The effect on the plant may or may not be due to penetration of the tissues. Where penetration occurs, the oil is most commonly found in the primary xylem, and to a lesser extent in the secondary xylem and the intercellular spaces of the pith and cortex.

87. SMITH, R. H., AND OTHERS. 632.951.1
The nicotine vaporizer, a device for utilizing nicotine in the control of insect pests.*
Science, 1935, **81** : 296-7.

A new machine is described by means of which nicotine sulphate or other forms of nicotine concentrate may be applied to orchard or field crops as a vapour produced by heat or as a vapour-like mist produced by atomization. Tests have shown that a tree with an approximate volume of 4,000 cu. ft. requires about 20 gallons spray mixture to ensure proper coverage. At the usual concentration of 1 pint nicotine sulphate in 100 gallons water this necessitates using 90 c.c. nicotine sulphate. Using the vaporizer 10 c.c. of nicotine sulphate will kill all codling moths in a tree of this size. A canvas cover dragged over the crop to be treated produces maximum effectiveness. A portable device has been constructed to enclose and treat trees at the rate of $\frac{1}{2}$ minute to each tree.

88. FOX WILSON, G. 632.7 : 634.1/2
Fruit pests : their effect and detection.
J. roy. hort. Soc., 1935, **60** : 536-44.

Fruit growers are advised to make a sufficient study of insect pests to recognize the early signs of attacks and the types of insects responsible for the many forms of injury. The plant as a whole must receive primary consideration. Damage to the roots, stem or foliage affects the whole system, whereas injury to organs such as the flower, fruit, or seed may have little influence. A knowledge of the life history of each particular organism and its method of feeding is essential before successful control measures can be applied. Insect pests are here grouped on a broad basis according to the type of mouth parts and the part of the plant attacked. Mention is also made of insects, such as sawflies and fruit flies, which cause injury by oviposition, and of the formation of galls and honeydew.

89. WRIGHT, J. A. 632.772
Control of fruit fly. Experiments with white oil-nicotine sulphate spray.
Agric. Gaz. N.S.W., 1935, **46** : 689.

Granny Smith apple trees were sprayed with a mixture consisting of 1 gallon emulsified white oil, 1 pint nicotine sulphate, and 80 gallons of water. Treatment was begun on December 27th, 1934, and applications of about 2 gallons per tree were repeated ten times, at about weekly intervals, until March 15th, 1935. At harvest unsprayed trees showed 82.8% fruit fly infestation, and sprayed trees 28.2%, a reduction of 66%. Results are therefore promising, but further tests will be necessary before recommendations can be made.

90. MUNRO, H. K. 632.77
Biological and systematic notes and records of South African *Trypetidae* (fruit-flies, *Diptera*) with descriptions of new species.
Ent. Mem. Div. Plant Industry, S. Afr., **9**, 1935 : 18-59, bibl. in text.

Descriptions or notes are given of a very large number of South African *Trypetidae*. Over twenty previously unknown host plants of various species are recorded, and a full list of host plants and an index of species are included at the end of the memoir.

* See also *H.A.*, 1935, **5** : 4 : 625.

91. RIPLEY, L. B., AND HEPBURN, G. A. 632.77
Olfactory attractants for male fruit-flies.

Ent. Mem. Div. Plant Industry, S. Afr., 9, 1935 : 3-17, bibl. in text.

A prolonged search to discover suitable baits for the Natal fruit-fly, *Ceratitis (Pterandrus) rosa* Ksh., have failed to produce a very satisfactory "female attractant", but certain chemicals have been found to attract males to a marked extent, and the present paper discusses their possible utilitarian value. The optimum concentrations are given for 12 of 17 male attractants listed in order of relative attractiveness. Terpinyl acetate placed second on this list has been found to attract males of thirteen species of trypetids, but failed to attract 27 other species, of which both males and females are attracted by pollard bait. The relative attractiveness of each material varies according to the species. Male attractants do not attract as food odours, but apparently imitate the odour of the female fly as sensed by the male. The conditions under which they are operative are restricted. Under laboratory conditions baits such as terpinyl acetate no longer attract males of *P. rosa* but strongly repel them. In a sub-tropical fruit orchard near Durban 120 Cedara traps baited with terpinyl acetate caught 58,500 males of *P. rosa* in six months. In locally bred populations the sexes occur in equal numbers, and the exact effect of reducing the proportion of males is unknown, but it is suggested that terpinyl acetate might be used for trapping the male of this fruit-fly on a commercial scale, but only in addition to pollard bait, which is a (rather weak) attractant for both sexes.

92. SPEYER, W. 632.77 : 634.23
 Die Fortschritte in der Erforschung und Bekämpfung der Kirschfliege (*Rhagoletis cerasi* L.) seit 1931 in Deutschland und in der Schweiz. (**Progress in the control of the cherry fruit fly in Germany and Switzerland since 1931.**)
Forschungsdienst, 1936, 1 : 102-8, bibl. 29.

The lonicerias, especially *L. tatarica* and *L. xylosteum* are dangerous host plants for the grubs and should be kept well away from cherry orchards. Wild and sour cherries can equally well fall victims and so are a source of danger to neighbouring sweet cherries. The best method of control is continued early picking of fruit and collection of fallen fruit and its immediate use or destruction. Spraying or dusting the trees with stomach or contact poisons is only successful when repeated very frequently, when the ground is very uniform and the climate is dry. The pupae can be successfully dealt with by soil treatment, which should be good for 2 years. This is best done with a heavy oil 8-10% carbolineum [applied about 5 litres to a square metre shortly before the insects emerge.—ED.]. (Author's summary.)

93. EVANS, J. W. 632.75 : 634.11
The apple leaf-hopper.
Tasm. J. Agric., 1935, 6 (n.s.) : 155-7, bibl. 2.

The apple leaf-hopper, *Typhlocyba australis* Frogg, known locally as the "Canary fly", probably first appeared in Tasmania about 1929, since when it has caused widespread concern amongst growers. An investigation has been recently started with a view to determining the incidence and life history of and the best control measures against the pest. It will include a study of possible local parasites, but, until results are forthcoming, the control advocated is spraying with 1 pint nicotine and 1½ lb. hard soap in 75 gallons water. The first application should be made when the earliest nymphs are just reaching the winged adult stage, probably in the first week of November. A second spray should follow 3-4 weeks later, and where infestation is severe it may be necessary to spray again towards the end of January to combat the second brood.

94. PESCOTT, R. T. M. 632.78 : 634.7
The currant borer moth. Life history and control methods.
Fruit World, Melbourne, 1935, 36 : 12 : 5.

The currant borer moth, *Aegena tipuliformis* Clerek, is a native of Europe. It was first reported in Tasmania in 1917, and in Victoria in 1927, since when it has become fairly widespread in

those areas. It is primarily a pest of currants, particularly black currants. Red and white currants, gooseberries and raspberries and several trees and shrubs may also be attacked, and it is predicted that, unless precautions are taken to check the pest in Victoria, the damage caused may ultimately become severe. The life history of the moth is described. The larva spends the whole of its life in the pith and wood of the canes, which show yellowish, undersized leaves with general die-back symptoms. Such canes should be cut out at ground level and burnt. Spraying is useless.

95. BALACHOWSKY, A., AND VIENNOT-BOURGIN, G. 632.78
 Note sur le cycle évolutif du *Carpocapse* dans la région parisienne. (**Note on the life cycle of the codling moth in the Paris district.**)
C. R. Acad. Agric. Fr., 1935, 21 : 1018-24.

Observations in 1934 and 1935 indicate that *C. pomonella* produces only 1 generation a year, the second being negligible. The so-called 1st, 2nd and 3rd generations are really only one generation drawn out. Egg laying does not take place before June. These data which are said to hold good probably for most of France are also stated to agree with those observed in Switzerland and in South-East England. The essential control would appear to lie in the use of increasingly stable arsenical compounds, possessing a lasting activity.

96. BOVEY, P. 632.78
 Observations sur le cycle évolutif de *Laspeyresia* (*Carpocapsa pomonella* L.) en Suisse Romande. (**The life cycle of the codling moth in French Switzerland.**)
Bulletin de la Murithienne, 1934-5, Fasc. 52, pp. 45-65, bibl. 25.

Observations on the flight of these insects in 1932, 1933 and 1934 indicates that 2 arsenical treatments, the first at blossom fall and the second 3-4 weeks later, are ineffective. They consider that the brightest hope of adequate control lies in a definite watch being kept yearly on their flight each year, as is done in the vineyard for conchylis (*Clysia ambiguella*) and polychrosis (*Eudemis botrana*), and treatments made accordingly.

97. FOWLER, R. 632.78
Codling moth control experiments, Blackwood, 1934-5.
J. Dep. Agric. S. Aust., 1935, 39 : 458-67.

Although the 1934-5 season was an "off" year for apples and pears, crops were not abnormally light, and one of the worst outbreaks of codling moth ever recorded locally occurred. The control experiments discussed here appear to be very largely a repetition of those described for the previous season (see *H.A.*, 1935, 5 : 4 : 622). Molasses as a lure in bait traps again proved more successful than apple vinegar, and traps covered with $\frac{1}{2}$ -inch wire netting again caught many more moths than did uncovered traps. As previously the proportion of females to males increased in the second brood to about 2 : 1. Two distinct peak emergence periods are shown, the first (spring) reaching a maximum at the end of November, and the second at the end of February. 189 bag bandages caught an average of 10.63 grubs each during the season. Bandages treated with beta-naphthol did not repel the larvae in any way, and at the end of the season the great majority of grubs in these were found to be dead or affected in some way by the chemical. The toxic properties appear to be dissipated during the winter, and the treated bands should be removed and burnt at the end of the season. No injurious effects were observed on the trees, but all the trees used had fairly old and rough bark. Spraying experiments with lead arsenate with and without white oil emulsions in various combinations gave inconsistent results, but all types showed a fair measure of control. White oil sprays following two or three lead arsenate sprays gave materially the same control as lead arsenate alone, and when used for the last three applications resulted in less arsenical residue. On the other hand the addition of white oil emulsion sprays increased the total cost of materials considerably.

98. OSBURN, M. R., AND LIPP, J. W. 632.76 : 632.944

Fumigation of fresh fruit to destroy the adult Japanese beetle.

Circ. U.S. Dep. Agric., **373**, 1935, pp. 29, bibl. 9.

Fumigation experiments using several materials as means of destroying the adult Japanese beetle in shipments of fruit for quarantine areas are described in detail. Twelve varieties of fruit, strawberries (2), raspberries, blackberries, peaches, plums, red currants, gooseberries, and blueberries (4), were treated with carbon disulphide in 1929. Four varieties of fruit, blueberries (2), raspberries and blackberries were treated with ethylene oxide in 1930. Bananas imported into the quarantine area were treated with ethylene oxide, calcium cyanide and hydrocyanic acid. Effects of fumigation on the beetles and fruit are discussed.

99. LISTO, J. 632.654.2 : 634.723

Eräitä kokeita herukan akamapunkin torjumiseksi. (Experiments on the control of the black currant mite *Eriophyes ribis* Nal.) [English summary.]

J. sci. agric. soc. Finland, 1935, **7**: 85-101, bibl. 10.

The experiments were made on rather badly infested bushes at two centres in Southern Finland. The materials used were commercial lime sulphur solution in water diluted 1 : 6.5 or 1 : 7, so that the S.G. of the liquid was 1.025, a 5% solution of solbar, sulphur dust, and naphthalene magnesia powder. The best results were obtained with two applications of the lime sulphur spray, the first being made when the flower buds were beginning to appear.

100. HOSNI, M., AND SHAFIK, M. 632.752

A mealy bug new to Egypt (*Pseudococcus brevipes* Ckll.) on roots of *Phoenix* sp. and its control by the application of chemicals to the soil.

Bull. tech. sci. Service (Entomological Section) Minist. Agric. Egypt, **159**, 1935, pp. 8, bibl. 13.

The mealy bug is described. Potted plants which appeared healthy despite heavy infestation were repotted in wider pots and five insecticidal compounds added in various doses. The plants were re-examined after two and again after three months. All the compounds tested gave promising results, but the actions of ortho- and paradichlorobenzene, and of mercurous chloride were more rapid than those of Seekay (a mixture of ortho-, para-, and metadichlorobenzene) or naphthalene. In two cases, where the original doses of paradichlorobenzene and Seekay were small, their effect apparently wore off after two months and the second count revealed a renewed increase in the number of mealy bugs present.

101. CRESSMAN, A. W., AND PLANK, H. K. 632.752

The camphor scale.

Circ. U.S. Dep. Agric., **365**, 1935, pp. 19, bibl. 17.

The distribution in the U.S.A., the life history, and natural enemies of the camphor scale (*Aspidiotus Pseudaonidia duplex* (Ckll.) are described. A long list of host plants, including camphor-tree, Satsuma orange, and various ornamental types is included. Petroleum oil emulsions make the most effective sprays. A winter application using 2.5%-3% oil is the most important, but for heavy infestations it must be supplemented by summer sprays of 1 part emulsion to 50-60 parts water. For nursery stock and many greenhouse plants fumigation with HCN affords effective control. Spray and fumigation schedules and formulae are given.

102. FERNANDEZ CASARIEGO, L. S. 632.5

Destrucción de las malas hierbas en los cultivos. (Destruction of weeds on cultivated ground.)

Econ. Tecn. agric. Madrid, 1936, **5**: 5-8.

The amount of loss caused by weeds is not properly appreciated. It has been calculated by Russian workers that normally 15% of crop space is occupied by weeds and under favourable conditions for growth this may be greatly exceeded. A reduction of crop of 20% due to the presence of weeds is not unusual. The manner in which weeds reduce the value of the crop is

set out. Apart from occupying space they reduce the humidity of the soil, exhaust its fertility and use up fertilizers. They often shade the ground and are natural hosts of numerous fungus diseases. Their seeds, moreover, contaminate seed crops. Weeds survive the attacks of man for one or more of the following reasons. Large production of seed (a single plant of field poppy, *Papaver Rhoeas*, will produce 50,000 seeds), powers of rapid vegetative reproduction, e.g. underground runners, a hard seed coat which will resist injury (corn cockle, chamomile), a rapidly permeable seed coat facilitating germination, rapid means of seed dissemination by wind, water, animals, or in improperly cleaned seed, prolonged longevity of seed which will germinate if brought to the surface after it has been buried for years (*Chenopodium album*, 62% after 7 years). The accumulation of weeds in well cultivated soil, awaiting a favourable opportunity to germinate, is estimated at 14,000 per sq. metre, rising to 45,600 if the land is badly tilled. These are not evenly distributed in depth, the majority being found in the top 20 cm. Yet another factor favouring successful competition with the cultivator is the successional germination of many weeds, some seeds germinating at once and some the following year.

VEGETABLE GROWING.

103. BEWLEY, W. F.

635.63/4 : 631.544

Twenty-one years' glasshouse research at Cheshunt.

Sci. Hort., 1936, 4 : 114-25.

The Lea Valley Glasshouse Industry started in a small way in 1876. In 1914 the Cheshunt Research Station was opened, its original aim being the investigation of all crops which can be grown or forced in glasshouses and frames. In view, however, of limited capital and the fact that cucumbers and tomatoes were the most important glasshouse crops, these were the first to be studied. *Plant pests*. The ravages of the tomato moth which had amounted to some £40,000 a year were reduced to a few hundred pounds for control measures. This was one of the earlier achievements of the station. Other pests successfully dealt with include the white fly, originally controlled by HCN and later by the parasite *Encarsia formosa*, and the red spider mite which is kept well in check by control methods evolved at Cheshunt. Special attention has also been paid to woodlice, thrips, cucumber root flies, chrysanthemum midge and capsid, vine *Tortrix*, millipedes, wireworms and eelworms. *Diseases*. By the end of 1922 practical methods of control—which have been in general use ever since—had been evolved for damping off, foot rot, buck-eye rot, stripe disease, sleepy disease and blossom end rot of the tomato. Other diseases for which adequate control has also been discovered at Cheshunt include *Phytophthora* infection of seedlings and tomato leaf mould, while breeding investigations suggest that the final remedy for the latter may lie in breeding. Virus diseases still provide problems to solve, but it is suggested that one of the most valuable discoveries from the growers' standpoint was made at Cheshunt, namely that the mosaic of tomato and cucumber arises from infected seed. *Crop production*. Laboratory investigations have accompanied practical work in the glasshouse in an attempt to put cultivation methods on a sound physiological basis and lately this work has embraced flowers, mushrooms and salad crops in glasshouse and frame. Soil sickness has afforded one of the greatest problems. It was found that where such a condition arises the soil fauna have become unbalanced in favour of the protozoa. Later Bewley and others have shown that parasitic fungi and bacteria accumulate in glasshouse soils and cause injury to a greater or less degree according to soil conditions. There is also evidence that poisonous nitrogenous compounds are found in old soils especially those of a heavy type. The cure lies in soil sterilization and the different methods of achieving this have been thoroughly examined at Cheshunt. Of these the new "Hoddesdon pipe" system of steam treatment would appear to be the best. The best subsequent cultivation of sterilized soil has also been examined and elucidated. Efforts have also been devoted to the prevention of the condition and it has been found that its incidence runs parallel to the loss of coarse organic material. The addition to the soil of coarse opening materials, such as straw, burnt clay and peat has met with considerable

success. Nutritional disorders and the relation between potash requirements and amount of sunshine have been investigated. *Breeding* work has resulted in new tomatoes, cucumbers and lettuce possessing particular advantages over old varieties. *Other investigations* include the effect of nutrients on composition, CO₂ manuring, soil heating, irradiation, improvement of market quality by care in cultivation, and better picking and packing.

104. REINHOLD, J. 631.588.2 : 631.544
 Osram- und Neon-Belichtungsversuche zu Fröhgemüsekkulturen. (**The effect of artificial lighting on early vegetable production.**)
Gartenbauwiss., 1935, 9 : 558-74.

A number of trials were made of giving additional light from Neon and Osram lamps, 6 hours nightly, to seedling early vegetables. The light was given until such time as the plants were moved to their final cropping quarters, when it ceased. Increased earliness and size was achieved with both types of lamps on radishes, neon results being the better. With kohlrabi the extra illumination proved definitely uneconomic. With lettuce seed was sown on 13.1.34 and the lighting began on the same day. The plants were illumined until 28.11.34 and then harvested. The weight of the neon lighted plants was nearly 3 times that of the untreated plants and the Osram treated plants were not far behind. Great success was given in the forced production of early cucumbers by treatment and, given economic power rates (0.10 RM. or about 2d.) per kilowatt and cheap equipment, neon lighting seems here to offer considerable promise. Tomatoes alone were susceptible to damage from neon lighting and better effects were obtained with the Osram equipment. A case for lighting tomatoes could not be shown on economic grounds.

105. REINHOLD, J., AND MARSCHKE, G. 635.1/7 : 631.8
 Bericht über Düngung in Gemüsebau. (**A survey of work on vegetable manuring.**)
Forschungsdienst, 1936, 1 : 47-57, bibl. 221.

The author summarizes the data yielded by the comparatively few important trials of vegetable manuring. The majority of the authorities quoted are German and of these he considers that particular attention should be given to the findings of Vogel and Weber and of Becker. He suggests that the results of a good number of the experiments hitherto made on the subject are not entirely satisfactory or to be relied on. Useful fundamental work has been done on the amount of nutrients removed from the soil, but very few controlled experiments have proved the effect of particular elements on particular vegetables. Deficiency work in pot and field trials has given varying results. Potassium deficiency has, however, been clearly shown in many cases, e.g. with beetroot, onions, chicory, tomatoes, cucumbers, cabbages, cauliflowers and carrots. In the case of peas Scharrer and Schropp found the effect of K to be very striking where light was at all deficient, whereas in the presence of abundant light it was much less noticeable. Phosphate deficiency has been found to affect considerably the growth of tomatoes and onions. Instances of N deficiency affecting growth are rarer, though cases noted have included cauliflowers, onions, and Chinese cabbage. Day has found a noticeable calcium deficiency affecting peas. Very little can still be said on magnesium deficiency apart from work on KMg. Excess sulphur derived from fertilizers has been found to damage cucumbers and melons. The best form of vehicle in which to apply any particular nutrient element varies very largely with the soil, though we also get certain preferences or intolerances shown. Thus onions are particularly susceptible to damage from the use of ammonia nitrogen: the leguminous vegetables and cucumber are susceptible to damage by the chloride potash salts, while celery and beetroot would appear to prefer it, and tomatoes like magnesium. Generally speaking there appears to be a liking for magnesium and a dislike of chlorine. As regards phosphates the water soluble forms would appear preferable to those soluble in citric acid or ammonium citrate. Kohlrabi and peas have a preference for raw phosphate. The importance of early manuring for crop production either at or prior to sowing (especially N and K) has been proved. The soil pH is probably of great importance, though most astonishingly varying results have been

achieved in experiments on this point. The superiority of mineral or organic manuring still remains undecided. Artificial farmyard manure offers definite promise of usefulness. Work on CO₂ manuring is in progress. Many elements appear to act as stimulants rather than as nutrients. It has been found that the addition of iodine to the soil increases the iodine content of the plant, but it is still uncertain whether the plant is otherwise affected at all. Boron deficiency has often been noted in tomatoes, leguminous vegetables, lettuce and beetroot. The presence of copper in the soil results in better skin colour in onions, and in peas the same element has induced greater frost resistance. The use of silicic acid has achieved isolated successes. Indecisive experiments have been made on the effect of radium, of zinc and of manganese, and on the effect of hormones, and though occasionally success seems to have been achieved with the following their influence remains unproved:—potassium bichromate, chloride of lime, potassium permanganate, manganese sulphate, lead nitrate and vanadium. There is little information on the effect of manuring on disease resistance other than that excessive N may increase susceptibility. Generally speaking, moderate amounts of mineral fertilizers increase eating quality and do not detract from storage life. Potassium and sodium increase sugar, vitamin and water content. In peas calcium gives an excessively hard skin. Generally speaking the value of the produce determines the advisability of manuring.

106. NEWHALL, A. G., AND NIXON, M. W.

631.462 : 631.588

Disinfesting soils by electric pasteurization.

Bull. Cornell agric. Exp. Sta., **636**, 1935, pp. 20, bibl. 30.

Two types of portable electric soil "sterilizers" are described, the one named previously the Ohio type, and the other now called the New York type. The action of both is to raise the temperature of soil placed in a special container or pasteurizer. In the Ohio type an electric current is passed directly through the soil, and in the New York type the current passes through resistance heating units, which, when properly spaced, impart their heat evenly to the soil by thermal conductance. Both proved effective in destroying a number of common pathogenes, including bacteria, sclerotial fungi, nematodes and weed seeds. Under suitable conditions it was found unnecessary to raise soil temperatures above 70° C. to kill several of these pathogenes, and results compare favourably with other soil sterilizing agents, such as formaldehyde and steam. All kinds of soil from pure sand to pure muck were treated effectively, but in both sterilizers a certain minimum initial soil moisture content, depending on the soil type, was found to be very important, while to ensure even heating care must be exercised to pack the soil in the pasteurizers in as uniform a manner as possible. When using the direct current Ohio type it is often necessary to add some dilute electrolyte solution, such as potassium nitrate, to sand, in order to raise the temperature within a reasonable time. The cost of the treatment is estimated at approximately 3 cents a cubic foot (at 3 cents a kilowatt hour). Both types of sterilizer have distinct advantages, but the New York type is perhaps to be preferred as being safer and simpler for the average operator. Attempts to sterilize benches and ground beds with standard soil-heating cable have so far proved unsuccessful.

107. CALDWELL, J.

635.63 : 631.453

The occurrence of copper poisoning in a glasshouse crop.

Ann. appl. Biol., 1935, **22** : 465-8.

Cucumber seedlings in a commercial nursery showed at an early stage symptoms suggestive of a virus disease. Leaves were distorted and chlorotic, and there was marked "clearing of the veins". In most cases some necrosis of the laminae was noted. Initial experiments showed, however, that the cause of the trouble was probably not a virus. Attention was, therefore, turned to differential soil and cultural treatments, but of those tested only the use of unboiled as against boiled pots eliminated the trouble. This led to an examination of the type of boiler used, which was found to have been previously repaired with "untinned" sheet copper. Copper poisoning was finally established as the cause of the chlorotic condition by experiments at Rothamsted in which various copper compounds in different amounts were supplied to cucumber seedlings, and produced symptoms not unlike those observed in the original plants.

108. HANNA, G. C. 635.31
Asparagus production in California.

Circ. Calif. agric. Ext. Serv., **91**, 1935, pp. 32.

This paper describes the cultivation of asparagus on a large field scale for canning and market purposes. Climatic and soil requirements, varieties, seed selection, nursery planting and management, transplanting the crowns to the field and subsequent cultural practices, replanting, manuring, harvesting for market and canning, sorting, grading and packing, loading, precooling, and refrigeration, insect pests and diseases are the titles of the principal sections.

109. HABER, E. S. 635.31
Effect of harvesting, spacing, and age of plants on yields of asparagus.

Bull. Iowa agric. Exp. Sta. **339**, 1935, pp. 16, bibl. 6.

The effect of length of cutting season on the asparagus variety Mary Washington spaced 2' x 4' has been estimated for six harvest seasons in Iowa. Results for three cutting seasons were reported in an earlier paper.* Cutting until June 15th has given the best results for the 6-year period. Cessation of cutting after May 1st, May 15th, or June 1st, proved less profitable, because, although quality of spears was improved, yields were decreased. Cutting until July 1st has proved profitable for the 6-year period, but there are indications that yield and quality are beginning to deteriorate. Cutting to July 15th left too short a subsequent growing season, and yields and average weights per spear declined in each successive year to the fifth season. In the sixth year the stand of plants was so poor that harvesting was discontinued. The effect of spacing was examined in a second experiment. 1-year-old plants were planted in 1928 in rows 3', 4' and 5' apart and spaced 1', 2' and 3' apart in the rows. Harvesting was continued up to June 15th in each year, and results are given for the three years 1932-4. 1' spacing in the rows produced the greatest number of spears throughout, but the lowest average weight per spear. Total yields were greater at 1' spacing than at 2' except for plants spaced at 5' x 1'. Differences between 2' and 3' spacing in the rows were too small to justify any conclusions, but both are satisfactory as regards size of spear and total yield. As regards distances between rows 3' rows are not recommended. 4' rows produced the greatest average weight per spear, but 5' rows the largest number of spears and the largest total weight. Optimum spacing will vary with soil type, fertility and cultural practices, but it is thought unlikely that there are any soils in Iowa, for which closer spacings than those tested could be recommended. In a third trial the effect of cutting a first crop to June 15th in the second and third season after planting 1-year-old plants was examined, and revealed that taking a crop in the second year reduced subsequent yields. Finally, seed sown in the field, or sown in pots and transplanted after 5 months in a greenhouse, proved definitely inferior to 1-year-old transplanted plants; 2-year-old plants gave very similar, but if anything inferior results to 1-year plants, and 3-year-old plants gave a markedly poorer stand and lower quality spears than 1-year plants.

110. SCOTT, G. W. 635.41
Spinach production in California.

Circ. Calif. agric. Ext. Serv., **92**, 1935, pp. 26.

Spinach is stated to be the most important crop grown for greens in the United States. Of the total acreage in California devoted to the crop about five-sixths or more is utilized for canning spinach. Climatic and soil requirements, crop rotations, manuring, cultivation and harvesting for canneries and for market are discussed, and five varieties are described. Of diseases downy mildew caused by *Peronospora effusa*, mosaic, and curly top are the most important and control measures are outlined. Physiological troubles such as chlorosis are mentioned under soil requirements. Among insects, aphides, the spinach leaf miner, *Chortophila hyoscyani* Panzer, the seed-corn maggot, *Hylemia cilicrura* Rond, and the cucumber beetle, *Diabrotica* spp., are most likely to do damage. A note is added on the culture of New Zealand spinach.

* *J. agric. Res.*, 1932, 45 : 101-9, *H.A.*, 1933, 3 : 1 : 72.

111. SHUCK, A. L. 635.52-1.521.5
A growth inhibiting substance in lettuce seeds.
Science, 1935, 81 : 236, bibl. 1.

The production of an inhibiting substance by lettuce seeds germinating both in light and darkness is suggested by several tests. In one 80% germination was obtained from Big Boston lettuce seeds when placed in the light at 25°C. on moist absorbent cotton compared with 3% when similarly treated on moist blotters, but the germination was reduced to 5% on the same cotton after 5 lots of 100 seeds had been in contact with it over a period of 5 days. The formation of the inhibiting substance occurs most abundantly in new seeds, just harvested, of the white-seeded varieties, and to a lesser extent, if at all, in old seeds.

112. ERNST-SCHWARZENBACH, M. 635.52 : 575.11
 Fertilität, Photoperiodismus und Genetik von *Lactuca sativa* L. (**Fertility, photoperiodism and genetics of *L. sativa*.**)
Züchter, 1936, 8 : 11-21, bibl. 11.

Work on the inheritance in lettuce of different factors by Bremer, Dahlgren, Durst and others is here discussed with special reference to length of day which is all-important. It is found that head formation depends on a recessive factor. It comes about only, if not only the leaf rosette factor is absent but also the factor which combines early shoot formation with long day is either absent or is ineffective owing to cultivation being done under short day conditions. The following are found to be dominant factors :—early shoot formation combined with long day, leaf rosettes, green foliage leaves, presence of anthocyanin, black seeds, hairy leaf midribs, lobate foliage leaves. The following are recessive :—indifference to length of day with delayed shoot formation, head formation, yellow foliage leaves, absence of anthocyanin, white seeds, smooth leaf midribs, unlobate foliage leaves.

113. LESLEY, J. W. 635.64
A tomato relative from Peru.
J. Hered., 1935, 26 : 451-3, bibl. 1.

Lycopersicum peruvianum Mill. (*Solanum peruvianum* Vacq.) possesses the same number of chromosomes as the tomato, and although it can hardly be classed with the five species or races of *Lycopersicum*, which constitute the tomato group, it is sufficiently like these to be of interest to the plant breeder. The pollen of *L. peruvianum* applied to the stigma of several tomato varieties readily caused setting, but although the resultant fruits were normal, the seeds were very small and failed to germinate. The variety Ideal Forcing yielded 14 seedless fruits in this manner. No fruits were set from reciprocal crosses. Although attempts to obtain fertile seed have so far failed, it is considered worth while making further trials on a much larger scale, and under different climatic conditions.

114. JONES, L. K., AND BURNETT, G. 635.64 : 632.8
Virus diseases of greenhouse-grown tomatoes.
Bull. Wash. agric. Exp. Sta. 308, 1935, pp. 36, bibl. 31.

Mosaic, streak, and mottle are the three virus diseases most commonly found among glasshouse tomatoes in Washington State. Of these streak is the most important. Their symptoms, and methods of transmission and infection are described in some detail, while a number of other minor virus diseases are described briefly. The following control and preventive measures are advocated for the three principal diseases :—Although seed transmission appears improbable, it is advisable to select seed from disease-free plants. Diseased plants should be removed and destroyed. Workmen should not use tobacco whilst handling tomato plants. Hands should be washed with soap and water after handling potatoes, tobacco, or diseased tomato plants. Weeds and volunteer potatoes in tomato houses should be eradicated. Tomatoes should be rotated with some other crop such as chrysanthemums to permit all virus infected tissue to decay, and the virus thus become inactivated before the next tomato crop. Frequent fumigation to control possible insect vectors, especially aphids, is advisable.

115. MORGAN, W. L. 635.64 : 632.654.2
The tomato mite (*Phyllocoptes lycopersici*, Tryon).
Agric. Gaz. N.S.W., 1935, 46 : 683-4.

In localities where attacks of tomato mite are common treatment should be a routine matter. In the field the cheapest and most effective control is spraying with lime-sulphur, 1 in 100, at least twice, first when the fruit begins to ripen and again one month later. If, however, bordeaux is being used to control diseases, lime-sulphur should not be applied, but should be replaced with a mixture of equal parts of hydrated lime and flowers of sulphur, or by 1 lb. wettable sulphur to 12 gallons water applied alone, or by wettable sulphur added to the bordeaux. Under glass dusting with sulphur is the best treatment.

116. NIGHTINGALE, A. A. 664.84.65 : 632.4
Development of *Phoma* rot of tomatoes in transit and in storage.
Circ. U.S. Dep. Agric., 371, 1935, pp. 8, bibl. in text.

The development of lesions caused by *Phoma destructiva* Plowr. on tomatoes shipped from Florida to Chicago and New York has been the subject of a study covering four different seasons.

117. SEARLS, E. M. 635.656 : 632.753
The relation of foliage colour to aphid resistance in some varieties of canning peas.
J. agric. Res., 1935, 51 : 613-9, bibl. 1 in text.

A constant relationship has been observed between the foliage colour of different varieties of canning peas, *Pisum sativum* L., and the reaction of the plant to injury by the pea aphid *Illinoia pisi* (Kalt.). Resistance is associated with yellow colour, and susceptibility with green. In the present study crosses were made between three varieties of pea, Yellow Admiral, a tall type with yellowish foliage and observed to show resistance to aphid attack, Perfection, a very susceptible deep-green dwarf variety, and Onward, a dwarf type resembling Yellow Admiral in foliage colour and resistance. In the F_2 generation the progeny were grouped on a basis of height and colour, plants showing intermediate colouring being discarded. Subsequently plants of the F_3 and F_4 generations growing in the field were artificially infected with equal numbers of aphids. Ensuing aphid populations were estimated, and showed that for both height classes plants with yellow foliage possessed resistance, whilst those with green foliage were susceptible. It is, therefore, assumed that resistance and susceptibility are inherited with the yellow and green foliage colour respectively.

118. CAMPBELL, L. 635.656 : 632.411
Downy mildew of peas caused by *Peronospora Pisi* (DeB.) Syd.
Bull. Wash. agric. Exp. Sta., 318, 1935, pp. 42, bibl. 24.

Downy mildew of peas has assumed considerable importance only in recent years in the states of the Pacific West. The symptoms, life history, and etiology of the fungus are here described in detail. Experiments in control have so far failed to yield any very conclusive results. Of sprays and dusts only bordeaux-penetrol mixture offered good protection, but then only in a limited greenhouse test when the time of inoculation was controlled. Of a large number of spreaders penetrol was the only one found effective for use with fungicides on peas, but if applied in excess it causes some burning of young foliage. Results from seed treatment with hot water and hot air were inconclusive. In areas where outbreaks of mildew are likely crop rotation is recommended. The use of seed from arid regions should be an expedient practice.

119. DEMOLON, A., AND OTHERS. 635.8 : 631.8
Culture du champignon de couche sur fumier artificiel. (Artificial farmyard manure for mushroom growing.)
C. R. Acad. Agric. Fr., 1935, 21 : 464-8.

The experiments of the author and his collaborators at Versailles show that by careful addition to normal farmyard manure of barley or oat straw, urea and water a suitable medium can be obtained in which to grow mushrooms successfully. In making such a medium the following

quantities were used successfully :—10 kg. urea, 1,000 kg. straw, 2,500 litres water and 1,000 kg. farmyard manure. After the first rise in temperature the mixture was turned and watered. Five successive turnings were made at 10 day intervals. The reaction thus attained was about pH=6.5, i.e. slightly acid as against a pH=8 of an ordinary bed, and to this is attributed the noticeable freedom from disease in the bed. The crop was a normal one. They consider that optimum humidity conditions are about 65-67%.

120. DAVIS, A. C., AND CLABORN, H. V. 635.8 : 632.944

Cyanide fumigation of mushroom houses.

Circ. U.S. Dep. Agric., 364, 1935, pp. 9.

A comparison of powdered and granular calcium cyanide sprinkled at a rate of 1 lb. per 1,000 cu. ft. air space on the alleyways in mushroom houses with equivalent dosages of $\frac{1}{2}$ lb. sodium cyanide plus acid ($1\frac{1}{2}$ fluid oz. acid, 2 oz. water to 1 oz. sodium cyanide) and $\frac{1}{4}$ lb. liquid hydrocyanic acid per 1,000 cu. ft. showed that the last two were much superior in the concentration of gas obtained. The cost of fumigation with sodium cyanide is per unit about half that of either of the other materials. The lethal effects of fumigation were studied in special chambers on the springtails, *Lepidocyrtus lanuginosus* (Gmel) and *Xenylla* sp., both adults and larvae, on all stages of the mushroom fly, *Sciara* sp., and on all stages of the mites, *Tyroglyphus lintneri* Osb. ; and *Histioglyphus* sp. To simulate conditions in a mushroom house temperature in the chambers was raised in 6-8 hours from 75° or 80° F. to 100° F., and then held at 100° F. for 7-9 hours before starting fumigation with HCN gas. Average results then showed that a concentration reaching a maximum of 3.6 mg. per litre with a mean of 1.67 mg. per litre, and requiring 44 minutes to drop to 0.4 mg. per litre, will prove lethal to all these insects. The kill produced under similar temperature conditions by concentrations showing a maximum of 2.9, a mean of 1.56 with a drop to 0.4 mg. per litre in 38½ minutes, was slightly under 100%, mites proving the most resistant. Prolonging the period of fumigation by inserting two-thirds of the charge at the outset and one-third 15 minutes later was found to be less effective than a single charge of the same total amount of material, which gave a higher maximum concentration, but a shorter exposure. Owing to leakages commonly encountered in mushroom houses it is recommended that the dosage should be increased to 10 oz. sodium cyanide or to 5 oz. liquid hydrocyanic acid per 1,000 cu. ft. air space.

121. COTTIER, W. 632.78 : 632.951

The use of insecticides in the control of the white butterfly.

N.Z.J. Agric., 1936, 52 : 24-9.

Although it is anticipated that imported parasites will control this pest fairly adequately on cruciferous crops, market and private gardens often require 100% control. A series of insecticides (sprays and dusts) was carefully tested. These were lead arsenate, calcium arsenate, barium fluosilicate, derris, pyrethrum summer spraying oil, nicotine sulphate, nicotine dust and common salt. Results showed excellent control with all concentrations of lead arsenate and calcium arsenate sprays ; dusts of these materials were less effective. Derris dusts and sprays were equally good. Barium fluosilicate sprays burned the foliage, while the dusts gave poor results. Nicotine sulphate sprays and dusts were inefficient. Pyrethrum dusts were useless but pyrethrum spray (1 : 160) gave fair results. Kerosene extract of fresh South African pyrethrum gave good results. Oil sprays alone were ineffective but good in conjunction with derris. Salt solutions of 4% had no insecticidal effect and burned the foliage. The experiments are continuing.

FLOWER GROWING.

122. GRAHAM, R. J. D. 631.535

Laurence Baxter Stewart's methods of vegetative propagation at Edinburgh.

Sci. Hort., 1936, 4 : 97-113.

This fascinating article gives a brief account of the methods and technique used so successfully by Stewart. It is impossible to deal in this abstract with more than a few of the points made.

Selection of cuttings. Very roughly from 1 to 4 inches in length of current year's growth is found best for indoor work. In most dicotyledons this forms part of the future plant, whereas in many monocotyledons it acts merely as a storehouse for the growth of a bud which gives rise to the new plant. The time at which cuttings should be taken is important and in many cases differences in site and exposure may be significant, thus *Escallonia* cuttings from a southern exposure rooted while those from a plant with a northern aspect did not, or again internodal cuttings of *Clematis montana* rooted well when the stems concerned had been shaded from full light for some years. As a general guide the cutting should be taken when growth is ended, the optimum time being determined by observation and experiment. [A propagation calendar for Edinburgh conditions for some 190 plants is given in an appendix.—Ed.] *Preparation and insertion of cuttings.* A clean cut by a sharp knife is essential for rapid healing and a transverse cut offers the smallest area for healing. Where the wood is stiff or brittle and liable to break, the cut should be first notched and the sloping cut thus produced pared until the end is transverse. Special devices are described for dealing with the special problems presented by resinous or latex-producing plants and by plants in which the presence of pigments, or essential oils hinders rooting. In certain plants excessive callus production does so, but rooting can generally be induced by paring the callus. Where callus is almost absent, as in some of the Australian *Leguminosae*, small cuttings with consequent reduction in water loss prove satisfactory. Stewart recommended the retention of the bottom leaves so as to reduce the area which requires healing. In the *Gardenia* Stewart found that cuttings from the terminal shoot make vigorous erect thorny trees—which under Edinburgh conditions never flowered even after 20 years—while cuttings from the horizontal branches produce a dwarf bush with larger leaves, no thorns and abundant flowers each year. Cuttings should be inserted in the rooting medium until they stand erect. For small numbers a 4-in. pot with cuttings round the edges is the best: in dry, warm conditions, a saucer of water beneath and a bell jar over the top will meet moisture requirements. For large numbers sand (preferably pure quartz sand) in unheated frames was Stewart's favourite rooting medium because of the free aeration thus obtained, while in heated cases coconut fibre replaced sand, which tends to become waterlogged in heat. *Suitable conditions for rooting.* Under no circumstances should cuttings be allowed to flag and in untreated frames this may mean hourly syringing. It is suggested that the success attained by the etiolation of apple shoots is not primarily due to the effect of blanching but to the fact that in the "sentry box" used for etiolation conditions lower the rate of transpiration and the potential cutting does not lose water so quickly. In frames the danger of *Botrytis* can be overcome by watering with a pink solution of permanganate of potash. As regards the reaction of the soil Stewart recommended the addition of 2-3 teaspoonfuls of vinegar in a gallon of water. Control of temperature is only second in importance to control of moisture. This is adequately controlled by thermostats or by the enclosing of unheated frames under glass. Finally notes are given on the various parts of a plant successfully induced to form roots by Stewart. He induced rooting even in inflorescences, e.g. broccoli curd. In certain plants root cuttings give the quickest results, in others leaf cuttings, e.g. primulas, begonias and various members of the *Acanthaceae*, *Gesneraceae* and *Melastoniaceae* also rooting well from leaves.

123. KRASSINSKY, N., AND ANDREJEWA, E. D. 581.144.2 : 547.313.2
 Ueber die Wirkung des Äthylens und des Acetylens auf die Bildung der
 Wurzeln. (The effect of ethylene and acetylene on root formation.)
Gartenbauwiss., 1935, 9 : 479-88, bibl. 2.

The authors repeated certain American experiments (*Contrib. Boyce Thompson Inst.*, 1935, 7 : 209-29 and 231-48, *H.A.*, 1935, 5 : 4 : 520, 521). They summarize as follows:—Our experiments on the effect of ethylene and acetylene on whole plants of *Coleus*, *Iresine* and *Tagetes* confirm the results of American workers. It must be noted, however, that aerial roots were formed in the case of *Coleus* and *Iresine* without the application of gas, though to a smaller extent. These species show a marked tendency to root formation specially in old plants. On *Coleus* and *Tagetes* aerial roots formed all over, but on *Iresine* only at the nodes. We were unable to induce aerial root formation in *Salvia* and *Heliotropium*, apparently owing to our somewhat

unsuitable experimental conditions. Untreated cuttings produced aerial roots but shorter and fewer than those induced by treatment with ethylene and acetylene. A speeding up of root formation in cuttings of such plants as *Coleus*, *Tagetes*, *Salix* and *Ribes* as well as increased development of the underground root system in *Tagetes*, *Ribes*, *Philadelphus* and *Cornus* are very interesting. Our data indicate that unsaturated hydrocarbons have in fact the power of stimulating root formation in plants. Unfortunately only in the case of a few plants were we able to hasten rooting or stimulate underground root production, but this lack of success may perhaps be attributed to unfavourable working conditions. In any future trials conditions must be so arranged that plants are not defoliated and that minimum disturbance of growth in the cuttings is ensured. Despite the comparative lack of success achieved it is essential that trials should be continued.

124. GOUWENTAK, C. A., AND HELLINGA, G. 581.144.2
 Beobachtungen über Wurzelbildung. (Notes on root formation.)
Meded. LandbHoogesch. Wageningen, Deel. 39, Verh. 6, pp. 6, bibl. 21.

It was found impossible to induce root formation in *Salix alba vitellina* and *Ligustrum ovalifolium* by means of diastase. The amount of heteroauxin present in yeast extract was quite enough to explain the root forming influence of the yeast extract. A dose of 0.01 gamma of synthetic indoleacetic acid is enough to induce strong root formation in *Coleus* cuttings. Heteroauxin induces cell division as well as cell lengthening. The formation of roots on control cuttings takes place under the influence of wound hormones. After a certain time root formation in *Coleus* cuttings stopped owing to lack of growth materials, but on their addition it was resumed. When growth materials are given in large quantities, the greater part of the heteroauxin is inactivated without having contributed to root formation. *Coleus* stems show a marked polarity in relation to the flow of growth materials. [Authors' summary.]

125. CAYEUX, H. 635.944 : 631.535
 Un mode nouveau de bouturage du dahlia. (A new method in dahlia
 propagation by cuttings.)
Rev. hort. suisse, 1936, 9 : 9-12.

The method consists of using as a cutting a single leaf of the dahlia with a small portion of the main stem attached. The leaves of the dahlia being opposite, two cuttings can be made from each joint. The new growth arises from the axil of the leaf whether the bud is visible at the time of taking the cutting or not. If the attached leaf is unduly large, a portion is trimmed off. Success largely depends on proper treatment until the cuttings strike. A sandy rooting medium with bottom heat is advisable. The cuttings must be kept no moister in the first days than is necessary to prevent them from wilting. Deep planting also encourages rotting. Careful experiments have shown that the resulting plants are in every respect the equals of those propagated in the usual way. This method has the advantage commercially of enabling a far larger stock to be propagated from any one plant than is possible in the ordinary way.

126. BÖHNERT, E. 635.939.183
 Züchterfolge bei der Fliederprimel. (Breeding successes with *Primula*
malacoides Franch.)
Züchter, 1936, 8 : 21-4.

After a discussion of results achieved to date the author notes that in the course of the years two distinct main types have been evolved, the descendants of which all present certain definite characteristics. Type I. The flowers are bright violet in colour with a yellow centre. Their diameter may exceed 3.5 cm. The shape of the flowering plant is conical and its height is 30 cm. This type is particularly suitable for pot culture and interior decoration. Type II. Flower colour as for type I, but individual flowers are smaller and flower shoots more numerous. This type is even more suitable for decorative purposes. Two of the most successful specimens of this type are *P. malacoides sanguinea* and *P. malacoides gracilis*.

127. HENNIG, K. 635.939.183
 Untersuchungen über den Primingehalt verschiedener Primelarten. (**Investigations on the primin* content of different Primulas.**)
Gartenbauwiss., 1935, 9 : 427-31, bibl. 4.

A method is described whereby a quick qualitative and quantitative determination can be made of the presence of this irritating principle in primulas. Certain varieties are found to be free from it and the recommendation is made that these should be used for breeding work.

128. MASSEY, L. M., AND JENKINS, A. E. 635.938.422 : 632.482
Scab of violet caused by *Sphaceloma*.
Mem. Cornell agric. Exp. Sta., 176, 1935, pp. 9, bibl. in text.

A species of *Sphaceloma*, which does not seem to have been described hitherto, and for which the name *S. Violae* Jenkins is suggested, causes a highly destructive scab disease of violets in parts of E. and S.E. United States and in N.S. Wales. Susceptible species include the sweet violet, *Viola odorata*, varieties Mrs. David Lloyd George, Double Russian, Freys Fragrant, Governor Herrick, Rosina, Princess of Wales and Princess Mary, and the pansy *Viola tricolor*, both species introduced from Europe, as well as several North American wild species. The fungus and the symptoms of the disease are described. Experiments with control measures have not been included in the study, but from reports from growers the most promising method found so far would appear to be spraying with bordeaux mixture, 4-4-50, at intervals of 10 days to 2 weeks from early July onwards.

129. TROY, Z. 632.8
Aster yellows and its control.†
Prof. Pap. Boyce Thompson Inst., 1935, 28 : 262-6, bibl. 6 in text. Reprint from *Flor. Exch.*, 1935, 85 : 16 : 13 and 17.

Symptoms of aster yellows and the vector of the virus, *Cicadula sexnotata*, a leafhopper, are described. A large number of alternate host plants are listed. Plots of asters surrounded by cultivated fields are less subject to severe infection than those adjacent to pastures and weedy places, and aster beds near buildings are also less subject, because the leafhopper avoids buildings. Where conditions are unsuitable for eliminating alternate host plants, the use of cheesecloth tents covering the beds and the destruction of aster plants at the first sign of yellows should provide effective control.

130. NOBLE, N. S. 635.944-2.73
The gladiolus thrips.
Agric. Gaz. N.S.W., 1935, 46 : 681-2.

The gladiolus thrips, *Taeniothrips (Physothrips) simplex* Morison (*T. gladioli* M. and S.) was first recorded as a pest in N.S.W. in 1932, and has subsequently caused severe injury to gladiolus crops each year. The insect is described, and control measures are outlined. These include making a break of several months between plantings, and the destruction of all volunteer plants to avoid winter breeding, storing the corms in flaked naphthalene, treatment with corrosive sublimate, or fumigation with HCN. A spray mixture consisting of 1 oz. paris green, 2 lb. brown sugar, and 3 gallons water as suggested by trials in Canada and the U.S.A.‡ has also proved effective here for treating the growing plants.

* A substance described by Karrer as melting at 62-63°C., having a molecular weight of 214 and a formula $C_{14}H_{18}O_8$ or $C_{14}H_{20}O_8$.

† A brief summary of L. O. Kunkel's work on the subject.

‡ These control measures are abstracted in detail in *H.A.*, 1935, 5 : 4 : 660 and 661.

131. MILLIKAN, C. R.

631.544 : 632.651.3

The bulb eel-worm and its control.*J. Dep. Agric. Vict.*, 1935, **33** : 563-6.

The stem or bulb eel-worm, *Anguillulina dipsaci* (Kuhn) Gerv. and v. Ben, is a worldwide pest of narcissus and hyacinths, attacking both bulb and leaves. The first symptom of infection usually is the appearance of small lumps or blisters, commonly termed "spikkels" on either surface of the leaf. These later crack open and turn brown, the surrounding tissue becoming yellowish. In severe cases the leaves and flower stalks become thick and distorted and often die back. The bulb when sectioned shows concentric rings of brown tissue in which the parasites may be found, and during storage such bulbs are very prone to decay. The eel-worm and its life history are described. Specialization of *A. dipsaci* is shown in that two distinct strains are concerned. Cross-infection between narcissus and hyacinth does not occur, but the narcissus strain may also infect onions and certain weeds, notably the rib-grasses *Plantago lanceolata* and *P. major*. The standard control method is to immerse the bulbs suspended in bags in water at 110°F. for 3 hours, which is also effective for controlling bulb mites and bulb fly larvae. The apparatus used should be designed to bring the temperature rapidly to 110°F. and thereafter show variations of not more than 2°F. on either side. Marked injury, especially to the subsequent flowers, may occur when the temperature exceeds 112°F. Similar injury may take place if the bulbs are not fully ripened, and for this reason the treatment should be delayed until the bulbs are entirely dormant, but before roots appear. Cooling after treating should take place slowly for 12 to 24 hours, and the bulbs should then be removed from their bags and dried rapidly by exposure to air. In subsequent storage great care should be exercised to avoid re-infection from unclean trays, etc. Steps should also be taken in the field to prevent the spread of the eel-worm from infested to clean areas by implements, infected bulbs, etc. Leaves from the diseased plants should be collected and destroyed *in situ*. The pest may be starved out after several years by keeping the area free of narcissus, onions, and weeds.

132. MCDANIEL, E. I.

635.937.9 : 632.7

Control of iris borer (*Macronoctua orusta* Grote).*Quart. Bull. Mich. agric. Exp. Sta.*, 1935, **18** : 92-4.

Among eleven different treatments applied from about the middle of August to the soil about infected iris plants only calcium cyanide at a rate of 1 oz. per square foot gave a satisfactory kill of the borer. It also destroyed the fully grown larvae of the lesser bulb fly, *Eumerus strigatus*. Where calcium cyanide came in contact with exposed rhizomes burning resulted, but no injury occurred when the rhizomes were first covered with dry sand.

CITRUS AND SUB-TROPICALS.*

133. UPHOF, J. C. T.

634.31 : 575.257

Wissenschaftliche Beobachtungen und Versuche an Agrumen. VIII. Morphologische Studien an einem Pfropfbastard zwischen der Apfelsine Pineapple (*Citrus sinensis* Osbeck) und der Bigarade (*C. Aurantium* L.) (**Notes and experiments on citrus varieties. VIII. Morphological studies on a graft hybrid between the Pineapple sweet orange and the sour orange.**) *Gartenbauwiss.*, 1935, **9** : 421-6, bibl. 10.

The tree here described is in a sweet orange orchard at Lowell, Florida, and would appear to be a true graft hybrid. It was originally a Pineapple sweet orange grafted on a sour orange stock. It would appear that on one occasion frost caused the head to die back almost to the graft union. When growth started again close to the union, the tissues of the sour orange and those of the variety must have formed a curious vertical union. The combination tissue thus started

* See also 4.

persisted through the whole tree with the result that throughout the tree characteristic features of both species are found side by side. The following points are noticeable :—The tree is somewhat smaller than its fellows of the same age and is more susceptible to frost. The leaves except those of offshoots from the stock itself appear to be identical with those of a normal Pineapple orange and like it are not subject to scab or verrucosis. The flowers again are indistinguishable, but directly the fruits set the phenomenon appears unmistakably in the absolutely distinct types of fruit, some being definite Pineapple oranges, others normal sour oranges. The variation is found not just in one or two branches but all over the tree, one twig on a branch bearing a sweet, another a sour orange. No intermediate forms have ever been noticed. On one occasion it is reported that on one of the main branches only sweet oranges were borne while the following year sweet and sour were borne as usual. The author suggests that a possible explanation may be that in the first year for some reason no fruit was set by the "sour" flowers.

134. PYNAERT, L. 634.3-1.541.11
 Les aurantiées du genre *Citropsis*. (The orange like species of the genus *Citropsis*.)
Bull. agric. Congo belge, 1935, 26 : 305-14.

Descriptions are given by which the various species can be distinguished from one another, and there is also a general description of the genus. The interest for practical horticulturists lies in the possible uses of *Citropsis* as stocks for citrus under certain conditions. In Washington under glass and in Florida in the open *Citropsis Schweinfurthii* Engl. has been used with success experimentally as a stock for oranges and grapefruit. Oranges, mandarins, grapefruit and lemons have been grafted on to *Limonia Poggei* Engl. in the Belgian Congo and it is stated that they grew better thus than on sour orange. *Limonia Poggei* is immune to attack from *Mono-hammus* sp., a wood boring beetle which does considerable damage to sour orange stocks in the Congo. Jaffa oranges grafted experimentally on *L. Poggei* at Laeken in Belgium are now, under greenhouse conditions, 6 feet high, are vigorous and have fruited.

135. TOXOPEUS, H. J. 634.3-1.541.11-2.411
 Die Züchtung von Unterlagen für *Citrus sinensis* Osb. immun gegen *Phytophthora parasitica*, die Ursache der gum disease in Java. (Breeding rootstocks for the sweet orange immune to *P. parasitica*, the cause of gum disease in Java.)
Züchter, 1936, 8 : 1-10, bibl. 11.

The author's aim is the production of stocks, whose seedlings will be ready for grafting in 1-1½ years and will be immune to *P. parasitica* and will be compatible with sweet orange worked on them. His crosses included most of the possible ones between the following varieties :—*C. decumana*, *C. nobilis*, *C. sinensis*, *C. Aurantium*, *C. mitis*, *C. aurantifolia*, *C. medica*, Japanese citron (*C. nobilis* hybr.) and rough lemon (*C. Limonia*). He discusses clearly and at some length the effect of the different pollens on the set of fruit and number of seeds in different combinations. He describes his technique and notes the time taken to carry out the necessary castration of the flowers and subsequent pollination. The achievement of a team of 3 Javanese assistants working on 6 days averaged 168 castrations and 227 cross pollinations per day. It was found among the seedlings that, where the male parent possessed some outstanding vegetative character visible early, it was generally easy to pick out the generative offspring at an early date. Where no such character was possessed, the process was rather harder. Actually the first selections were made at 6 months from sowing. A list is given of the percentage of generative offspring noted by himself and by Webber and by Frost, arising from the seed of different varieties. The percentage varies according to the pollen plant and examples of this are given in the case of Japanese citron and rough lemon as mother plants. After getting his seedlings his next step was to bud with sweet orange. This was done when the seedlings were from 1-1½ years old, those too small at this date being rejected for good. Rather less than half the seedlings came up to this standard. He found that the first symptoms of faulty growth generally appeared some 2-3 months later.

At the end of 2 years very few remained healthy. His procedure has been 6 months after budding to plant the healthy, worked seedlings out at 1×1 m. A year later they are again transplanted to 3.5×3.5 m. At the times of transplanting only the definitely diseased plants are rejected, in case those which do not appear to be thriving may owe their poor condition to environmental factors. Actually he has found that very few indeed of these original "poor doers" make good. Those seedlings which have passed the test of the first year or two of grafted life and on which the sweet orange seems to be growing well are now being tested for resistance to *P. parasitica*. This is not quite so easy as would appear probable. At first he tried injecting the fungus mycelium into small holes of the bast, but he found that *P. parasitica* lives—though not quite so happily—in the bast of immune specimens also. His second method was to stick patches of sporangia-bearing mycelium at the base of the stem just prior to rain. Results were negligible. Finally he has infected the soil with fungus cultures to the best of his ability and has planted his crosses in the infected soil and proposes to watch them carefully for the next 6-8 years. It seems possible from results to date that none of the F1 generation of immune and susceptible crosses will prove immune and that they will have to be sought for in the F2 generation. His present method of getting material from promising seedlings is first to bud the seedling crosses—as described above—with sweet orange and about 3 weeks later cut off the piece of the seedling remaining above the buds and work this on Japanese citron using 2 buds for safety. He considers that, for the future propagation of homogeneous material from any successful seedlings at present under trial, raising from seed offers a cheaper and surer way, thanks to the marked incidence of polyembryony in citrus crosses, than does propagation from cuttings.

136. CHEVALIER, A. 634.3
 L'acclimatation des citrus en Afrique tropicale. (*Acclimatization of citrus in (French) tropical Africa.*)
Rev. Bot. appl., 1935, 15 : 658-75.

Citrus is not indigenous to West Africa, although such near relatives as *Citropsis*, *Balsamocitrus*, *Aeglopsis*, etc., are. These, however, have no value other than to serve as possible rootstocks for citrus and work on this subject still remains to be done. Introduced varieties succeed well enough, and in this paper a number of them are discussed individually. The notes are mainly concerned with the history of their introduction to Africa when known, a description of the tree and fruit, its distribution in French West Africa and its reactions to the various local climates and soils. Cultural instructions are not given.

137. LACARELLE, A., AND MIEDZYRZECKI, C. 634.322
 Contribution à l'étude du Clémentinier au Maroc . . . (*A study of the Clementine orange in Morocco with special reference to the presence or absence of pips.*)
Reprint Terre marocaine, 1936, pp. 19-25.

The Clementine is probably a cross between the tangerine and the sour orange and its fruit is said to resemble that of a very good tangerine. It grows naturally in several localities in Northern Africa. The authors have had it under observation for some years with a view to its more frequent cultivation and although they are only now establishing definite experiments to test their conclusions, they have already obtained useful indications on its habits, etc. The name Clémentinier is found to include a large number of types exhibiting very different characters of fruit and hence of greatly varying value. The best of them, i.e. those with good characters fixed and not just the result of environment, are well worth selection and perpetuation. The presence or absence of pips appears to depend essentially on pollination conditions. Those which are self-fertilized produce practically seedless fruits. The presence of seeds is due to cross pollination by the mandarin and the number of seeds is in inverse ratio to the distance away of the mandarin trees. The presence of pips being undesirable, it is suggested that any

separate plantings of the Clementine orange should be made at least 250 metres from the nearest mandarin grove and that there should be a wind break in between. It is also suggested that once a good strain has been selected it may be worth while topworking existing mandarin orchards.

138. ALLWRIGHT, W. J. 634.3-1.542.24

Girdling of citrus trees. Progress report.

Citrus Gr., 1935, No. 43, pp. 17-23, bibl. 4.

Experiments are in progress in three orchards in the Rustenburg district of the Transvaal on the girdling of Washington Navel trees. The trials were started in 1932. The trees in all cases were fourteen years old, well grown, vigorous and uniform. The girdling was done with a sharp pruning knife, making a single cut through the bark around the trunk about 8" above the bud union. Where repeated in subsequent seasons the cuts were made 2" or 3" above the previous rings. The operation was performed in September, when about 80% of the petals of the main blossom had fallen. The results to date are tabulated and would appear to indicate that girdling increased the weight of fruit per tree compared with controls for the first crop after treatment. Regirdling the following September also produced an increase in yield in the second crop, but this was distinctly less pronounced. When trees were not regirdled, the second crop was lower than that of the trees which had not been girdled at all. Girdling appears to have reduced the size of the fruit slightly in one orchard, but in neither of the other two. It had no appreciable effect upon the results of juice percentage tests, maturity tests, or flavour. Shoot measurements were only started in 1934, but previous observations do not suggest any marked effect from girdling. Until further evidence is available, it is recommended that girdling on a commercial scale should be definitely discouraged in the Western Transvaal.

139. PREST, R. L. 634.3-1.542

Pruning of citrus trees in Queensland.

Qd. agric. J., 1935, 44: 760-77.

The principles involved in pruning orange, mandarin, and lemon trees are discussed. The young tree is best despatched from the nursery carrying a large head, when it can then be shaped by the grower as desired. Bruised and broken roots should be removed. The pruning of young trees should be confined to the removal of unwanted shoots. If the tree initially has three main arms, only two secondary branches should be allowed to arise from each of these. Subsequently sucker growths and misplaced limbs are generally best removed. The top should not be permitted to become too dense, but should also not be thinned to an extent at which the main branches may become subject to sun scalding. In most cases knee-high branching is satisfactory, but branches should not be allowed to touch the ground and to blemish the fruits they carry. In old trees heavier pruning, including the removal of branches, may be necessary to maintain vigour and the production of new fruiting wood. Mandarins grow more densely than oranges and need more thinning, and this should be done when growths have hardened properly and ceased elongating. Pinching out an inch or so of the tips may be done to check excessive growth. Lemon trees are frequently pruned too severely each year. Strong upright branches should be selected initially. These eventually become weighted down at the ends and produce strong side shoots which should be thinned when necessary, leaving a number to replace the original leader shoots. The weighing down of branches reduces their vigour, and induces fruitfulness in their laterals. When these laterals are shortened, cuts should be made well back into ripe wood to stimulate dormant buds. Methods used for the rejuvenation of old and decadent trees include deheading, i.e. cutting back to 3-4 main arms within 18"-24" of the main stem, or a modification of this, in which secondary branches are stubbed back to 12" or so, and thirdly, skeletonizing, which is less drastic and is now generally preferred. In this case the entire framework of the tree is usually left, but cross limbs, unnecessary leaders and diseased shoots are removed or shortened, and an entirely new fruiting system is built up from the remaining skeleton. Trees so treated need protection from sun scald, and all exposed limbs should be coated with a suitable whitewash such as quick lime 7 lb., powdered sulphur 2 lb., salt, flour, or size 1 lb.

140. PAULIAN, G. 634.322-2.183
Influence des haies de cyprès sur les récoltes de mandarines. (The effect of
cypress hedges on the cropping of mandarins in Algeria.)
C.R. Acad. Agric. Fr., 1935, 21 : 1074-85.

The author has made careful observations on the returns of individual rows of a 2·16 ha. mandarin orchard (about 5½ acres), shape rectangular, length about double breadth, surrounded with a hedge of cypresses 49-65 ft. high on three sides and 13-16 ft. on the fourth side, and planted some 21½ ft. from the nearest row of mandarins. His first observations were made for the 1932-3 crop and his later ones after the suppression of the entire hedge on one of the long sides for the 1934-5 crop. The crop in 1934-5 was considerably greater than that before the suppression of the hedge. The various factors concerned, i.e. wind, frost, root competition, are all touched on in an interesting manner and the results observed serve chiefly to show the necessity for determining by further experiments the most appropriate spacing of protective belts.

141. WAHLBERG, H. E. 632.183 : 634.1/8
Protecting the orchard against wind.
Calif. Citrogr., 1936, 21 : 102-5.

A survey of citrus groves in California in 1933 showed that those protected by efficient windbreaks returned 90 dollars per acre more than unprotected orchards in a season when prices were universally low. In California the blue gum, *Eucalyptus globulus*, is the most suitable tree. It is easily raised from seed and develops the greatest height in a shorter time than any other tree. The usual practice is to plant 4 to 5 ft. apart in the row and to head back every other tree after 3 or 4 years' growth, to within a foot of the ground. The headed trees produce a substantial wall of suckers and branches in the lower part of the screen. A new bushy variety, *Eucalyptus globulus compacta* is now coming into use as a filler, and if it proves of value it will be planted alternatively with the tall species. Other possible fillers are discussed such as the Monterey and Arizona cypresses, both of which suffer from pests, and the Forbes cypress, indigenous to Orange County, which is now under trial and showing a good record for rapid growth and freedom from disease. *Eucalyptus globulus* seedlings should be planted out in their permanent positions when about 5 inches high. If allowed to grow much larger in the seed bed the root system may suffer to the future detriment of robust growth. A warning is given against planting the trees too close to the boundary or too near the orchard row. Ample space must be allowed for good root development and anchorage between the tree and the line where the root cutting operations begin. In exposed areas as much as 10% of the orchard can profitably be devoted to windbreaks. In windy fruit-growing districts a communal windbreak planting every ten acres is suggested as a suitable way of dealing with the problem. In cultivation it should not be forgotten that windbreaks require as liberal treatment as the orchard trees, at any rate in their early stage, and they may even require an earlier irrigation.

142. RABAT, DIRECTION GEN. D'AGRIC. 634.3-2.183
Les lésions causées aux fruits d'aurantiacées par action mécanique du vent.
(Wind damage in citrus fruits.)
Memento Dir. gen. Agric. Rabat, 28, 1935, pp. 6.

The damage, consisting of ugly markings on the fruits, occurs chiefly when the fruits are very small immediately after petal fall and is caused by the rubbing of branches or leaves or by the pricking of thorns or in sandy districts by soil particles blown up. The remedy lies in adequate wind protection and pruning.

143. REED, H. S., AND DUFRENOY, J. 634.3-2.1
The effects of zinc salts on the oxidation process in plant cells.
Science, 1935, 82 : 249-50, bibl. 8.

Attention is called to several recent scattered publications on the specific action of zinc on cell metabolism. Among these the authors summarize their own findings on the effects of zinc salts on the cell structure of mottled orange leaves.*

* *Hilgardia*, 1935, 9 : 113-41, *H.A.*, 1935, 5 : 3 : 447.

144. SINDONI, A. 634.334-1.83
Influenza della concimazione potassica sopra la cicatrizzazione delle ferite nei
frutti di limone. (**Effect of potassic manuring on callus formation in wounds
on lemon fruits.**)

Ortofrutticoltura ital., 1936, 5 : 7-8, bibl. 6.

The author notes that potassium has already been shown to induce in citrus plants such particular properties both physiological and histological as render the plants more resistant to parasitic and meteorological factors. He here briefly describes 2 years' experiments. In the first year he gave 500 gr. K_2SO_4 to lemon trees in January, a similar dose in early April, and in May he superficially wounded the fruits formed by the flowers of the previous summer with a scalpel. The fruits were picked and examined 103, 108 and 113 days after the date when the first dose of manure was given. Practically no differences could be found in cork formation. The second year using the same manured plants he carried out the same treatment and observations. The wounds made on 29th April and the fruits picked on 3rd, 10th and 17th May. In the 3rd May fruits no difference could be seen, but in those picked on 10th May a noticeably larger number of cell strata with suberized walls could be seen round the edges of the wounds in the manured than in the unmanured fruit. This feature was even more noticeable in the fruit picked on 17th May. The author describes the differences in the other cells adjacent to the wound and concludes that the process of healing is identical in control and in manured fruits, the difference lying in the fact that the phellogen forms more rapidly and is greater in the manured than the unmanured fruits.

145. ANON. 631.67
The measuring of water.
Citrus Gr., 1935, No. 43 : 5-9.

There are two points that every irrigation farmer should ascertain, the amount of water which is being applied to the land, and the depth to which it penetrates the soil. The latter is best determined by digging holes with a spade. The former may be estimated by erecting a gauge, of which there are two types, the V notch and the rectangular weir. The V notch may be used for streams up to 2 cu. secs., and the weir for any volume ordinarily dealt with in farm irrigation. In both cases a free fall of at least 9" or preferably 1' from the notch or sill of the weir to the furrow below is essential. The gauge should be placed in a straight stretch of the stream to avoid eddies and cross currents and the water above it should be headed back to form a still pond. The weir should be set carefully at right angles to the stream with the top horizontal, and the V notch erected likewise with the apex of the V pointing vertically downwards. The depth of water flowing over the notch is read on a vertical measuring stick erected 3' upstream. The stick should be graduated in hundredths of a foot and tenths of an inch, the zero being placed on an exact level with the apex of the V. Tables are provided indicating the discharge in cu. secs. as related to the head of water in feet, and the discharge in gallons per 24 hours as related to the head of water in inches. Hence the double graduation necessary on the measuring stick. The same measuring system is used for the rectangular weir, but the volume of water will be partly regulated by the length of weir crest selected. A table is provided showing the discharge in cu. feet per second for lengths of 1 to 10 feet for various heads of water measured in feet. Finally various data considered useful in making calculations are given.

146. SUMMERVILLE, W. A. T. 632.752
White wax scale.
Qd. agric. J., 1935, 44 : 556-9.

The white wax scale, *Ceroplastes destructor* Newstead has increased considerably in Queensland during the last few years. It attacks citrus, and is also found on a number of other plants, notably river cherries, *Gardenia*, persimmon, and guava. A general description of the insect and its habits and life history is given to assist growers to distinguish it from other allied types. Control measures are advocated principally as a means of preventing further possible increases in infestation. Where only a few trees are slightly attacked the affected portions should be cut

out and burnt. For larger or more numerous colonies spraying is advised at a time when the greatest number of crawlers is present, which would appear to be in January or early February. The most satisfactory scalecide consists of $1\frac{1}{2}$ lb. fresh washing soda to 4 gallons of water, but a resin-caustic soda-fish oil mixture, resin 10 lb., commercial caustic soda 3 lb., fish oil, preferably herring, $1\frac{1}{2}$ lb., water 40 gallons is also very effective, and has the additional advantage of controlling other scale insects and the bronze orange bug. Fumigation with HCN is generally impracticable because of climatic conditions.

147. SUMMERVILLE, W. A. T.

632.752

Pink wax scale.

Qd. agric. J., 1935, 44 : 404-8.

The pink wax scale, *Ceroplastes rubens* Mask., is abundant throughout the coastal regions of Queensland. From an economic standpoint it is only important as a pest of citrus, notably mandarins and Washington navel oranges, being less common on other oranges and seldom serious on grapefruits or lemons. Many other plants are, however, attacked including mango, fig, banana, guava, pomegranate, river cherries, pepperina, maiden-hair and other ferns. Two complete broods are produced each year, the first usually appearing towards the end of November or early December, and the second most commonly in early March. Spraying, to be effective, must be timed properly. The crawlers are frequently distributed by wind, and it is thus essential to wait until possible migration from outside sources is as nearly completed as possible. The most satisfactory general scalecide was found to consist of 24 cakes of Sunlight soap [weight unspecified—Ed.], 12-14 lb. of fresh washing soda, 75 gallons of water. Another effective spray is $1\frac{1}{2}$ lb. washing soda to 4 gallons of water, but this is rather drastic for the trees, especially during hot weather. A third mixture consisting of 10 lb. resin, 3 lb. caustic soda, $1\frac{1}{2}$ lb. fish oil, preferably herring oil, and 40 gallons of water is particularly useful when the brood emergence is protracted, because it will destroy much older individuals than either of the other sprays. Hydrocyanic acid gas fumigation will also kill pink wax, but not quite so efficiently as most other scale species. Copious development of sooty mould or fumagine almost invariably accompanies pink wax and the removal of this from the fruit is often necessary. For light infestations brushing may be sufficient, but where washing is necessary a solution containing $\frac{1}{4}$ lb. boracic acid and $\frac{1}{4}$ lb. chloride of lime to 1 gallon water has been found to be most effective during the present season.* After immersion in the solution the fruit should be thoroughly washed and dried before packing.

148. SHAFIK, M., AND AMER, A. A.

632.944 : 634.3

Efficiency of commercial sodium cyanide and sulphuric acid in liberating hydrocyanic acid gas for fumigation.

Bull. tech. sci. Service (Entomological Section), Minist. Agric. Egypt, 160, 1935, pp. 6, bibl. 7.

In using the pot method for the fumigation of citrus trees with HCN the chemicals have generally been mixed in the ratio, sodium cyanide 1, commercial sulphuric acid 1.25, and water 2. In the experiment described in this paper it was found that both acid and water could be reduced without reducing the amount of HCN liberated. Allowing a margin of safety for errors of measurement in the field the ratio proposed for future use is NaCN 1, H₂SO₄ 0.9, water 1.6.

149. RIPLEY, L. B., AND HEPBURN, G. A.

632.772 : 634.3

Fruit-fly in citrus : results with sodium fluosilicate bait.

Sci. Bull. Dep. Agric. S. Afr., 143, 1935, pp. 8.

A severe outbreak of Mediterranean fruit-fly in citrus in Kat River District led to the investigation of control measures in 1932-3, the results of which are summarized in this paper. A new bait spray consisting of $\frac{1}{4}$ oz. sodium fluosilicate, $\frac{1}{2}$ lb. white sugar to 1 gallon of water, was tested. The liquid was applied with a syringe, holding 6 fluid ounces, on two or four sides of each tree at about 3 oz. to each shot. Each tree received a total of 3 to 12 oz. according to size.

* This process has been described in more detail from South Africa and is noted in *H.A.*, 1935, 5 : 3 : 450.

Check areas were sprayed with sugar and water only. The number of flies present was estimated from glass traps baited with clensel and revealed in every case a marked decrease in fruit fly population in the poisoned as compared with the unpoisoned plots, a day or two after treatment. Subsequently the numbers gradually evened up again. Fruit flies fed on the bait for a week or more, but it is probable that the poison leaches out with dew and becomes ineffective before the last of the sugar disappears. The cost of applying the bait at a rate of 12 oz. per tree, i.e. 7½ gallons per 100 trees, three natives being able to treat 2,000 trees per day, works out at 1s. per 100 trees. Trapping is not recommended as a control method in this area, because spraying is cheaper and more effective, but traps are indispensable as a guide, indicating when and where to spray. The recommended arrangement is one Cedar glass trap to every 50 trees, baited weekly with clensel diluted to 1 : 30. Spraying should then be done during invasions, or whenever the traps show an appreciable rise in population. Work was also done on migrations with a view to eliminating, if possible, sources of winter invasion.

150. BARNES, H. 634.653

The avocado.

Qd. agric. J., 1935, 44 : 621-5.

Of the two distinct species of avocado the Guatemalan should be given preference under Queensland conditions, because it is a hardier grower and the fruit possesses a thicker skin, more resistant to fruit fly, than the Mexican type. Budding or grafting is necessary because seedlings do not come true to type. The time taken by the rootstock seeds to germinate is variable, but a general average in warm weather is about one month. Budding by the "T" method may be done when stock diameters are $\frac{1}{16}$ to $\frac{3}{8}$ inches. The spring, twelve months after planting, is the best time, budsticks being selected from terminals just prior to this, and stored in damp sand till required. Planting out is done in the following winter. The best soil is a good loam, and it must be well drained. Planted on the square a spacing of 25' is suggested, giving 70 trees per acre. Of the many varieties of avocado introduced into Queensland by the Queensland Acclimatization Society during the past twelve years the following have proved suitable:—Fuerte Hybrid, Blakeman, Grande, Goodwood, Justice, Pankey, Spinke and Robinson, particularly the last one which is the largest fruiting type.

151. PARODI, E. 634.653

L'aguacate (*Persea gratissima* Gaertn.). (**The avocado.**)

Ital. agric., 1935, 72 : 865-81, bibl. 8.

A comprehensive account of all phases of avocado growing, taken mainly from American sources. This fruit plant has been under investigation for some years at San Remo by Calvino and has been sent from there for trial in different parts of Italy. Its economic cultivation in Italy seems to offer considerable promise.

152. HORNE, W. T., AND PALMER, D. F. 634.653-2.42

The control of *Dothiorella* rot on avocado fruits.

Bull. Calif. agric. Exp. Sta., 594, 1935, pp. 16.

Dothiorella rot caused by *Botryosphaeria ribis chromogena* Grossenbacher and Duggar (*Dothiorella gregaria* Sacc.) develops visibly on avocados after picking when softening or "breaking" has started, but initial infection usually occurs through stomata of fruits attached to the tree. Experiments have shown that fungicides, liquid rather than dusts, can exert complete control, a bordeaux and sulphur mixture being the most effective and wettable sulphur alone the next most effective. Three spray formulae are recommended:—(1) Where no fumigation is contemplated—commercial bordeaux or 4-4-50 home-made bordeaux 16 lb., wettable sulphur 6 lb., blood albumin spreader 6 oz., water 100 gallons. (2) Where fumigation has just been done—wetable sulphur 6 lb., blood albumin spreader 6 oz., water 100 gallons. (3) Combining treatment for *Dothiorella* rot and mottle-leaf—zinc sulphate crystals 16 lb., copper sulphate 1 lb., fresh hydrated lime 8 lb., flotation sulphur 6 lb., blood albumin spreader 6 oz., water 100 gallons. In all cases the first application should be made when the fruit is about 1½ inches in diameter, and a second 6-8 weeks later. Overhead irrigation increases the amount of rot.

153. MCKENZIE, H. L. 634.653-2.6/7
Biology and control of avocado insects and mites.
Bull. Calif. agric. Exp. Sta., 592, 1935, pp. 48, bibl. 84.

The author gives a full account of the *Latania* scale (*Aspidiotus lataniae* Sign.) and its control, of the omnivorous looper (*Sabrilodes caberata* Gn.), of *Amorbia essigana* Busch, and of the brown mite (*Paratetranychus gothersi* McG.), and shorter notes on other pests. He concludes with a comprehensive compilation of the avocado pests of the world and an extensive bibliography.

154. ECHEGARAY, M. 633.85
El Aleurites Fordii o árbol del aceite tung. (**The tung oil tree.**)
Econ. Tecn. agric. Madrid, 1935, 4: 184-90, 221-5, 254-6, bibl. 16.

This is an examination of the possibilities of the profitable establishment in Spain of plantations of *Aleurites Fordii* for the production of tung oil. A very complete account is given of the tree both from the botanical and cultural standpoint. Much has been written lately on the cultivation of *Aleurites* and has been duly abstracted in *Horticultural Abstracts*. To avoid needless repetition only the more interesting observations will be recorded on the present occasion. *Soil.* The most suitable soils appear to be those of some acidity with a pH of from 5.6-8 and rich in humus but well drained. Alkaline soils or soils with a higher pH are unsuitable. An excess of tricalcium phosphate in the soil produces bronzing of the foliage and will kill the tree. *Climate.* A climate which has a cold period corresponding to the time when the tree, which is deciduous, is dormant is most suitable, but in general the temperature should never fall below 20°F., though established trees have withstood 10°F. A rainfall of 30-40 inches is necessary, though the tree will withstand severe droughts provided these are only occasional. *Manure.* The tree requires a balanced fertilizer and suffers if nitrogen is deficient. No correlation has been found between manuring and the oil content percentage of the seeds. *Propagation by seeds.* The seeds, which quickly lose their viability, should be sown in nursery beds, and covered to a depth of 5-10 cm. Germination will take about 2 months. *Vegetative propagation.* Cuttings have not given good results. Desirable varieties can be budded on to stocks of one or other of the five species of *Aleurites*. Seeds sown in February are often fit for budding or grafting by September. *Transplanting and cultivation.* Transplanting should be done when the trees are dormant and with as little damage or exposure of the surface roots as possible. Planting distances are about 30 x 30 ft. *Pruning.* As the tree flowers only on the terminal shoots of the previous year any pruning must reduce the crop. It should be confined, once the tree is formed, to the removal of dead or crossing branches. Forming the young tree presents some difficulties, since cutting back the leader does not result in the production of lateral branches. The removal of a small strip of bark just above the spot where branching is desired will often cause shoots to appear. *Harvesting* consists simply in picking up the nuts from the ground after the crop has fallen. They can be left lying 4 or 5 weeks without harm. After air drying they are sold to the factory. The machinery for the extraction of the oil is described and illustrated. Experimental plantings of *Aleurites* have been laid down in nearly every country where success might be expected. A brief note of the success or failure of these trials to date is given for each country. Several horticultural varieties of *A. Fordii* exist already and these are described. Pests and diseases, of which at present there are very few, are noted.

TROPICAL CROPS.

155. FRÉMONT, TH. 63: 581.08
Le rôle des stations agronomiques dans différents pays d'extrême-orient en particulier à Java. (**Agricultural research stations in the Far East with special reference to Java.**) [English summary.]
Ann. agron., 1936, 6: 99-116.

A brief note on the agricultural research stations of the Far East is given, followed by a more detailed and enthusiastic account of the agricultural research organization in Java.

156. ANON. 633/634
 Notices sur quelques plantes tropicales utiles. (**Notes on some useful tropical plants.**)
Bull. agric. Congo belge, 1935, 26 : 167-212.

The journal celebrates its 25th anniversary by the issue of a number containing descriptions and numerous accurately coloured plates of useful tropical plants. The plants dealt with are groundnut, arrowroot, avocado, banana, cacao, coffee, sugar cane, *Hevea*, coconut, cola, cotton, yam, jute, mango, cassava, oil palm, papaw, sweet potato, quinine, castor oil plant, sesame, and vanilla.

157. WHITE, J. TH., AND HARDON, H. J. 581.084.1 : 631.85
 Potproeven met inheemsch natuurlijk aluminumphosphaat als meststoff.
 (**Pot experiments with natural aluminum phosphate.**) [Dutch-English summary.]
Landbouww., 1935, 11 : 33-66, bibl. 16.

The investigations were started because of the presence in Java of large quantities of natural aluminum phosphate. Rice was used as the test plant. The conclusions reached were as follows. Natural aluminum phosphate is an active phosphatic fertilizer ; the effect of aluminum phosphate compared with other phosphates is higher in alkaline soils than in soils with an acid reaction ; in limed soil, even in heavy calcareous marl soil, its effect is higher than that of double superphosphate.

158. PAUL, W. R. C., AND CHELVANAYAGAN, A. V. 633.524.1
Sunnhemp in the Jaffna peninsula.
Trop. Agriculturist, 1936, 86 : 23-7, bibl. 3.

Crotalaria juncea, sunnhemp, is an important fibre crop in the Jaffna peninsula, Ceylon, while it is also a useful fodder crop or green manure. The stem fibre is used for making fishermen's nets while the pods and seeds are fed to cattle. As a green manure in the dry zone it is valuable as producing a large quantity of green material in a comparatively short time. It succeeds the paddy crop and is sown in February or March taking $4\frac{1}{2}$ months to mature. The best fibre is reputed to be obtained when the pods are fairly mature. Irrigation is sometimes used, though it will withstand drought to a marked degree. Insect pests are apt to be troublesome in dry weather. The most suitable soil is a moderately deep, well-drained loam, heavy clay or light sand yielding poor crops. In dry districts fairly close sowing, 96 lb. per acre, is usual to allow for non-germination on account of drought. The seed is broadcast on ploughed land which is then cross ploughed. When the seed pods are ripe the crop is cut close to the ground and in dry districts left to wither on the field for a few days, which reduces the period necessary for setting. Before this takes place the seed pods and leaves are removed. The leaves and roots left on the field after harvesting have a good manurial value and consequently it is not necessary to manure the succeeding paddy crop. If, as in garden lands, the whole sunnhemp crop is required as a manure, it is dug in when about seven weeks old. Used as a fodder the pods and seeds, which can be stored indefinitely, have great value, while the green plants after drying when mixed with paddy straw greatly improve its flavour and digestibility. The yield of fibre is 400 lb. per acre in the Jaffna peninsula, but in India it amounts to 500-800 lb.

159. DEUSS, J. J. B. 633.72
 Le thé et plus spécialement la sélection du théier. (**The tea plant and its selection.**)
Rev. Bot. appl., 1935, 15 : 580-603.

The history, geography and classification of the tea plant is first reviewed, and the problems of selection for improvement of yield and quality are then discussed. *Selection in the plantation.* The author takes the view that further striving after the perfect type is profitless. Plenty of good types exist possessing the characters which are generally acknowledged to be necessary,

i.e. large, supple, curved leaves, plenty of well-developed tips devoid of red colouration, and lastly vigour. Certain teas in Java combine a better than average aroma with reddish points, but reddish points produce tough leaves and a tea which is bad except for its aroma is not appreciated. *Seed gardens.* In Java and Sumatra seed selection gardens have been established with seed obtained from the seed gardens of the English and Dutch East Indies, and, therefore, as pure as possible. These seeds are reselected before planting by a process which involves the elimination of bad seed. On immersion in water or, for more drastic selection in 25% sugar solution, the seeds which float are found to contain 21% of bad types whereas those which sink contain only 7%. After germination and transplanting to nursery beds tough leaved or red tipped forms are eliminated. Some months later any plants showing flower are discarded. At a further transplanting, this time to the seed garden, weakly, late or aberrant forms are rejected. Good cultivation is given and an open bush to admit the light is maintained. Such gardens produce about 750 seeds per tree per annum. *Selection for yield.* There is no correlation between quality and yield. Attempts at propagating high yielding, good quality plants vegetatively have met with small success, though cuttings and various types of layering show promise. *Seed gardens selected on yield.* Two methods are advocated. (1) Seed bearers are cut back to 60 cm. from the ground and individual yield is determined by 15 pickings. The high yielders are kept, the others are eliminated or grafted with wood from the high yielders. (2) The second method is for use where the seed garden is still non-existent. A nursery is prepared either in the forest or with a planted belt of quick growing trees surrounding it. This belt must be at least 25 yards in depth. Seed selection proceeds as already described. After 2-3 years one-fifth of the plants, the most vigorous, are selected. It has been proved with mathematical exactitude that the heaviest and best developed plants are the best yielders. Formerly plants were weighed but determination is now done by eye on the spot. Good top growth and good root development are highly correlated. A year after replanting the yields of selected plants are individually recorded for 15 pluckings. A retention of the whole 20% originally selected plants gives an increased average yield of 31.4%. If the best 1 or 2% of these are selected this increase may be doubled. *Plucking gardens established following selection for yield.* 20% of the finest stumps are selected and planted in a garden known to be productive. 20% of the best of the remainder are planted in a second garden. The third best 20% can be grafted and all others discarded. It has been established that elimination of 20% of the lowest yielders means a loss of 8% on production, so that the replacement of these by 20% of high yielders will lead to a substantial increase in production. [It should be noted that although he advises grafting tea in certain cases, the author admits that it is not an easy operation.—ED.] The remainder of the article discusses questions of world consumption of tea.

160. DEUSS, J. J. B. 633.72-1.542
 La taille du théier en Indochine. (*Pruning tea in Indo-China.*)
Rev. Bot. appl., 1935, 15 : 153-70.

Various methods of pruning for plants in different conditions of growth are described and numerous diagrams are given.

161. GILBERT, S. M. 633.73
 The objects and scope of the coffee research and experimental station.*
Pamphl. Dep. Agric. Tanganyika Territory, 15, 1935, pp. 10.

The site, climate, equipment, personnel, and constitution of the new coffee research station at Lyamungu are described briefly, and the author then proceeds to outline the programme of work to be undertaken. In general the object of the station is to find improved economic means of producing coffee, taking into consideration liquoring quality, appearance, yield, and resistance to diseases and pests. For this purpose the line of work is being divided into seven main sections:—(a) Plant breeding work in conjunction with Amani, especially a first survey of the range of variability shown by coffee trees on a number of estates. (b) Comprehensive rootstock

* See also *H.A.*, 1935, 5 : 4 : 690.

studies. (c) General physiology, in conjunction with Amani, to discover primarily the relationship between environment and flowering and fruiting. (d) Agricultural practices, especially a study of shade trees, manuring, and methods of improving native coffee culture, but including other aspects of cultivation such as pruning, planting, preparing the bean for market, and cost of production. (e) Chemical studies, a soil survey and nutritional studies. (f) Mycology. (g) Entomology. A plan of the station is included showing the various experimental plots.

162. PORTÈRES, R. 633.73-1.53/4
 Multiplication végétative des caféiers en Côte d'Ivoire. (**Végétative propagation of coffee on the Ivory Coast.**)
Rev. Bot. appl., 1935, 15 : 682-94, bibl. 14.

Methods of grafting coffee throughout the world are first discussed. The only one departing from common practice is that which the author calls sub-cotyledon approach grafting. In this method, used to graft *arabica* seedlings on to *liberica* seedlings, the two varieties were sown side by side and approach grafted together on the hypocotyl under the cotyledons, one of the latter being removed from each plant. (The method can also be used without the removal of the cotyledon.) The union was complete and the scion established on the new rootstock within two months. Although complete severance may be then performed, a gradual pinching back of the *liberica* top over the ten months which ensue before transplanting helps to strengthen the union and gives the plant the temporary additional benefit of the *arabica* roots. Young seedling *arabica* shoots bearing two pairs of leaves and a terminal have also been side-grafted on to a seedling *liberica* just under the cotyledon. The grafts above mentioned must be kept close, under shaded glass for a week after the operation. The article then outlines the results of recent research on rootstock and scion combinations in various countries and proceeds to discuss such work as has been done on the Ivory Coast. The natives propagate largely by cuttings. At the Man Research Station in 1930 75% of cuttings of *C. canephora* 20 cm. long were successfully rooted after a journey occupying 5 days on which they received no special attention. Other similar successes followed. Mention is made of native plantations of *C. canephora* grown from cuttings over a metre long and having a diameter of 7 cm. They were planted upright in groups of 3 and gave a group success of 80%. At Bingerville in 1934 tests were made to discover the relative ease with which various sorts of coffee would root from cuttings. The cuttings used were 20 cm. long and 1-2 cm. thick. The underground end was cut on the slant, the upper end being cut straight and waxed. The cuttings were planted upright in light, sandy soil and given a top dressing of dry leaves. Moderate watering was given. The cuttings were inserted, 100 of each of 17 varieties, in August and the results were recorded in November. *Liberica* varieties from Buitenzorg gave 83% success and *excelsa* from the Belgian Congo 1%. The others gave results well under 50%. Grafting experiments were also carried out at Bingerville in 1934. The author remarks that, while grafting coffee is very easy in theory, in practice it is quite the reverse. The variety used for stock and scion was Gros Indénié. The methods used were whip and tongue, cleft, and herbaceous grafting (i.e. using the green wood of stock and scion), rind grafting and shield budding. The best results with each method were obtained in July-August, the ties being made with raffia and without grafting wax. Attempts at other times of the year gave unsatisfactory results. The use of grafting wax also seemed to interfere with the success.

163. MALLAMAIRE, A. 633.73-1.531.37
 La désinfection des semences de caféiers par la chloropicrine. (**Disinfecting coffee seeds with chloropicrin.**)
Agron. colon., 1935, 24 : 70-9, bibl. 7.

The coffee seed beetle (*Stephanoderes hampei* Ferr.) of central equatorial Africa was not reported on the Ivory Coast until 1923, though it has undoubtedly existed there for very much longer, even if it is not indigenous. The damage done by this insect may be anything from 5%-80% of the crop. It shows preference for the varieties with a thin pericarp such as coffees of the group *canephora*, e.g. *robusta*, Kouillou, Petit Indénié, etc., and also for *arabica* where this is

grown. Laboratory experiments in fumigation with chloropicrin resulted in 100% mortality after the application of 5 mg. of chloropicrin per litre of coffee cherries for 8 hours, 15 mg. for 2 hours or 50 mg. for 1 hour. The eggs were also killed. In germination tests with seed from cherries which had been fumigated as above before depulping, but with a 25% increase in the period of fumigation, germination was unaffected, though the fumigated seeds were from 2-6 days later in starting into growth; they soon caught up with the controls, however. Lethal doses for coffee seed were found to be in the neighbourhood of 20 gm. per cubic metre for 12 hours, or 125 gm. per cubic metre for 1 hour, so that care must be taken not to exceed the doses found fatal to the insect.

164. KRUG, C. A. 633.73-1.523
Hybridization of coffee. A preliminary study of flowering habits, and of methods of crossing.

J. Hered., 1935, 26 : 325-30, bibl. 5.

A detailed genetic investigation of the species *Coffea arabica* was started in 1932 in the state of São Paulo, Brazil, in connexion with an extensive breeding project. In this paper the technique evolved for selfing and crossing coffee flowers on a large scale is described. Under local conditions the main flowering period occupies 2-3 days shortly after the first rains in September or October. Less intensive flowering precedes and follows this period. Transfer of pollen is performed principally by insects, but probably also to some slight extent by wind. In addition, all commercial types are self-fertile, and the author considers that self-pollination may occur within the flower-buds, when these are closed on cloudy days. He disagrees with Taschdjian's statement that self-pollination is prevented owing to the relative positions of stigma and anthers. In selfing, ordinary paper bags, about 12" × 18", and elongated cloth bags have been used to cover individual branches about 1 day before the flower buds open, all small fruits originating from previous flowerings being first removed. The bags can be removed about 6 days after flowering when any styles and stigmas that are still white and turgid, indicating failure of fertilization, should be cut off with small scissors. This method has given sets up to 80%. In crossing a simplified form of Cramer and van der Wolk's method has been used. The flowers of the female parent are emasculated with a specially adapted pair of scissors about two days before they would normally have opened, and the branches are then bagged. At the same time flowers of the male parent shrub are bagged to prevent contamination with foreign pollen. After 2-3 days, when the stigma lobes are generally well expanded and receptive, flowers from the male parent are transferred for pollination. 6,215 flowers artificially pollinated in 1933 produced slightly over 50% set, and these fruits furnished about 6,000 hybrid seeds.

165. FRANCOIS, E. 633.73-1.56
Le rôle de la fermentation dans la préparation des cafés. (Fermentation and coffee drying.)

Rev. Bot. appl., 1935, 15 : 176-9.

The harm done to coffee quality by improper or careless fermentation is described and many instances are quoted. Fermentation has never been found to *improve* coffee and therefore the author urges that the advice of the Coffee Institute of São Paulo, Brazil, should be taken. This is that the coffee should be depulped and the berries subsequently washed in running water, a process which will remove all traces of pulp without the need of fermentation.

166. TISSOT, P. 633.74
Améliorations récentes apportées à la culture du cacaoyer et à la préparation du cacao dans le monde. (Recent improvements in cacao cultivation and preparation.)

Rev. Bot. appl., 1935, 15 : 103-15, bibl. 11.

This paper consists of a slight review of the progress made in cacao research in various countries. In the matter of selection and vegetative propagation the work done in Trinidad takes foremost

place and the results are given in some detail. The ecological requirements of cacao in various countries is next described, with special regard to soils and climates. In view of the number of different soils on which cacao will succeed it appears that soil is of less importance than climate. Manurial trials are discussed. A formula that has been used with success in Trinidad for over 8 years on soils with a more or less neutral pH is as follows :—sulphate of ammonia 250 kg. per hectare (222·5 lb. per acre) ; phosphates, natural or super, 150 kg. per hectare (133·5 lb. per acre) ; sulphate of potash 100 kg. per hectare (89 lb. per acre). Notes are given on nursery work and of planting distances. A spacing in the permanent positions of $4\cdot75 \times 4\cdot75$ m. has given the best yields per acre. The methods of fermentation and drying used in West Africa are described and certain disadvantages pointed out. Finally, the financial position of the cacao industry throughout the world is examined. [All the more important results of experiments alluded to by the author have already formed the subjects of abstracts in earlier numbers of *H.A.*—Ed.]

167. PITTIER, H.

633.74-1.523

Degeneration of cacao through natural hybridization.

J. Hered., 1935, 26 : 385-90, bibl. 5.

In early days the cacao of Venezuela was entirely of the criollo type, which is considered to be the true *Theobroma cacao* L. About 1825 the so-called trinitario cacao, a form derived from the calabacillo, *T. leiocarpum* Bern., was introduced from Trinidad. The author describes the two forms, and traces the steady degeneration in the quality of Venezuelan cacao through the introduction of this inferior type. No attempt was made at selection as in Trinidad where the intermediate forastero form was evolved. An endless variety of types has arisen producing more and more heterogeneous beans, and hence steadily worse grades of commercial cacao. A small experiment is described which may indicate that types akin to *T. leiocarpum* show greater pollen viability than criollo types, and may help to explain the way in which the characteristics of the former type have become so markedly dominant.

168. BONDAR, G.

633.74-1.415

Influência de acidez e alcalinidade do solo sobre o crescimento do cacau.

(Influence of soil acidity and alkalinity on the growth of cacao.)

Campo, Brazil, 1935, 6 : 10 : 40.

Cacao seedlings from the same tree were grown under otherwise identical conditions in nutrient solutions having a pH of 10, 8, 7, 6, 4 respectively. The seeds in the alkaline solutions germinated first. In a few days the capillary roots of the seedlings in the acid solutions turned black and died, thus paralysing any further growth of the plant. The same results were obtained when the experiment was repeated. On this occasion the plants tried to send out rootlets higher up the stem, but as soon as these reached the solution they also died. Development in the alkaline solutions was strong at first, but after about 10 days a retardation was noticed compared with the plants in the neutral solution. In 15 days the capillary roots which had been abundant began to die and fall to the bottom of the glass, particularly in the solution with pH 10 and to a lesser degree in the pH 8. The main roots, however, persisted. In the neutral or slightly alkaline solutions top and root growth was good. In all cases the aerial portion of the plants remained alive till the end of the experiment. A concrete example within the author's experience of the disastrous effects of planting cacao trees on a reclaimed alluvial sandy soil with a pH of 5 to 6 is given. After 2 or 3 years thousands of trees had entirely disappeared while thousands of others had made no growth. A small experimental planting was then made on the same ground using healthy plants from bamboo pots. These all died. The original vegetation consisted mainly of *Cyperaceae* and it is pointed out in conclusion that the presence of vegetation of this type can be taken as a definite indication that the land carrying it is unsuitable for cacao.

169. LEJEUNE, J. B. H. 633.812 : 668.526.2
 Recherches sur la geranium rosat. (Notes on the cultivation of *Pelargonium radula* var. *rosodora* in the Belgian Congo.)
Bull. agric. Congo belge, 1935, 26 : 379-87.

This plant, a native of South Africa, is the source of oil of geranium. It grows extremely well at the temperate altitudes of the Belgian Congo (6,000 ft.) in spite of a generally misty atmosphere. Excessive humidity is prevented in these localities, however, by frequent drying winds and high evaporation, so that the high rainfall is not only harmless to the plant but is in fact necessary. A calcareous sandy loam is a suitable soil, though, provided there is sufficient drainage, any ordinary soil is suitable. Manuring is necessary for high yield and 30,000 kg. of farmyard manure per hectare [about 11 tons per acre—Ed.] is indispensable in the ordinary run of local soils. If, however, the ground possesses some natural fertility, manuring may not be needed until the 3rd or 4th year. The residue of distillation should be returned to the ground as a valuable fertilizing material. An annual application of chemical manures is advised as follows:—200 kg. nitrate of lime, 250 kg. superphosphates, 150-200 kg. of sulphate of potash per hectare [178, 222 and 133-178 lb. per acre—Ed.]. In districts where there is a long dry season, moderate irrigation will keep the plants growing and increase the yield. The crop must be kept free from weeds. Propagation is from cuttings placed in nursery beds. Terminal cuttings containing half-ripened wood are the best. If the wood is too old, results are less satisfactory. Three harvestings a year or perhaps 5 in two years are made in warmer districts and 2 harvestings annually in more elevated regions. In the latter the first crop is taken when the plants are flowering and the leaves are strongly aromatic, and the second when the leaves are beginning to yellow. In districts where labour is cheaper only the leaves should be gathered. The stems may also contain the essential oil but it is inferior in quality and will reduce the value of the whole. The theory that wilting the leaves under shade for 48 hours produces an increase in the oil content was not properly tested by the author owing to inadequate apparatus. This question will be studied later, but it is quite certain that methods of manufacture do have an important influence on yield. Notes are given on distillation with such machinery as is likely to be available locally. The article concludes with a discussion of the yields obtained and the markets available abroad.

170. POSTMA, A. 633.834-1.541.5
 Voorloopige mededeeling over het oculeeren van nootmuskaat. (Budding the nutmeg.)
Landbouw., 1935, 11 : 450-2.

The nutmeg (*Myristica fragrans*) in Java when grown from seed gives about 45% of male or hermaphrodite trees. This is far in excess of the number needed for adequate pollination. Experiments in budding, using *Myristica succedanea* as a stock, were undertaken. These stocks grew slowly from seed and were not ready for working till a year after sowing. The method used was the modified Forkert. After a series of failures, due apparently to rapid drying out of the budwood, a moderate success (26 out of 82) was achieved. The budwood after cutting was soaked for a day in water and after insertion was immediately enveloped in a banana leaf. The budwood used was half ripened, unpetioled wood, and strong buds from stem suckers gave the best results. The stocks had a diameter of $1\frac{1}{2}$ cm. The raffia tie was loosened after 20 days and the stocks were cut back to 20 cm. above the eye a week later. The buds began to shoot in about 2 months and thereafter the plants showed good growth. The maintenance of the inserted bud in a moist condition appears to be essential.

171. TIRON, L. 633.85 : 665.326.42
 Contribution à l'étude des huiles chaulmoogriques indigènes du Congo Belge.
 (Chaulmoogric oils indigenous to the Belgian Congo.)
Bull. agric. Congo belge, 1935, 26 : 315-21.

The true chaulmoogric oil, a therapeutic against leprosy, is produced by the seeds of *Taraktogenos Kurzii*, a forest tree of Indo-China. The tree is difficult of access and fruits but

sparingly. *Hydnocarpus anthelmintica* from Cambodia is also a source of an oil which is used in leprosy. In this case research seems to point to its bactericidal action being due rather to the hydnocarpic acid it contains than to the chaulmoogric acid. In the case of West Africa Gorli oil produced by *Oncoba echinata* (Flacourtiaceae) is the nearest approach to chaulmoogric oil. In the Belgian Congo *Caloncoba glauca* supplies a chaulmoogric oil, as does *Caloncoba Welwitschii*, from the seeds or the cake made therefrom. The former appears to be the most productive. The residue contains a cyanogenetic principle and cannot be fed to cattle, but from its richness in phosphoric acid, potash, nitrogen and lime it should prove a useful manure for the poor soils of the Congo. A close investigation into the potentialities of these trees is overdue and would certainly yield useful results.

172. SANTIAGO, W.

633.853.55

Algumas considerações sobre a mamona. (Concerning the castor oil plant.)

Bol. Agric. Zootech. Vet. Minas Geraes, 1935, 11 : 11-5.

After cattle and cotton the castor oil plant (*Ricinus*) is the most valuable product of the district of Sao Francisco, Brazil. The selection of a site for a plantation is important because at the prices obtainable the product will not bear the cost of a lengthy transport to market. The ideal soil is a sandy loam well supplied with humus, but in practice any well-drained, moderately fertile soil will do. A badly-drained soil is not tolerated by the plant. The plant is raised from seed and it is important that this seed should be from local plants that give good yield and quality. It has been found that seed from varieties with a good reputation in one district has produced indifferent results when brought into another locality. The following points should be observed when collecting seed for reproduction. Select an open growing and early ripening plant with a loosely formed cluster, well ripened, which will provide an easy dehiscence, although in the case of the non-dehiscent kinds it is not possible to collect entirely dry seed. Select only the seeds from the basal half of the fruit cluster and discard all that differ from the standard. The seed is usually sown 3 or 4 to a hole and covered to a depth of 5 cm. After germination all except the best seedling per hole are eliminated. Planting distances vary from 3 m. \times 3 m. to 2 m. \times 1.80 m. according to the robustness of habit of the variety. The soil should have previously been worked to a depth of about 10 cm. The best time to sow is in the 15 to 20 days preceding the rainy season or in the 15 days after its termination. The first of the three hoeings should be given when the plants are 1 ft. high, and the soil may then be mounded round the stems. The terminal shoots are also removed to encourage branching and to maintain a low stature for convenience in picking. *Ricinus* being a soil exhausting crop benefits from manurial treatment. Particulars of the system, however, are not given here, as the author states that the cultivators for whom he is writing could not afford it. He will, however, furnish details on request. It is not always easy to determine when the seed is ready for gathering, because in the varieties which dehisce easily pods on the lower part of the bunch are seldom quite dry and the last two seeds are often never shed. Nevertheless the seed will be perfectly ripe and the best indication is the opening of the upper capsules of the cluster. With easily dehiscent varieties harvesting should never take place within 3 or 4 days after rain, because the moisture of the soil greatly influences the turgidity of the seed capsules. With the varieties that do not dehisce easily the seed can be left until the capsules are completely dry, without danger of the seed falling. After gathering, fanning machinery for artificial drying, the capsules are sun-dried, the easily dehiscent varieties requiring 1-2 days to shed their seed and the more difficult kinds 3-4 days. Impurities including the capsules are then removed by winnowing. The article ends with a note on the commercial prospects.

173. RAMANNA, N.

633.861.3

Cultivation of turmeric in Hassan Taluk.

J. Mysore agric. exp. Un., 1935, 15 : 136-40.

In this district turmeric (*Curcuma longa*) is grown on wet lands usually in rotation with rice. It is not grown in garden lands as the drip from the trees and root competition with other plants is considered detrimental. The soil though moist must not be waterlogged and black soils

with an admixture of limestone appear to be the most productive. Cattle manure and silt earth containing limestone nodules is usually added to the soil and ploughed in. The best rhizomes only are selected for planting. These are prepared for planting by being loosely heaped under cover and covered with a thin layer of rice straw over which is superimposed a thin coating of cow dung. They remain thus for 2 months before planting. Planting distance is 1 ft. apart in and 2 ft. between the rows. Planting depth is 4 inches. The first leaf appears in a month and takes 10 days to unfurl after its appearance above ground. Irrigation is by percolation from drains surrounding the crop. Direct irrigation would spoil the crop. After weeding, which takes place 6 weeks after planting, the rows are earthed up and receive no further attention till harvest. Harvesting begins in the second week in January and lasts 3 weeks. The tubers are dug up, the finger like processes at the sides of the rhizomes are detached, the central tubers being preserved for replanting. Curing is by boiling for 5 hours in cow dung water until the tubers become soft and pulpy with subsequent air drying in the threshing yard. This lasts 5 days and nights, the night exposure being supposed to improve the colour. The pale yellow colour of the dried turmeric does not appeal to the customer, so an improved yellow colour is produced by soaking the turmeric in a liquid made of tamarind water and a small quantity of powdered turmeric.

174. COOK, O. F.

633.912

Hevea rubber trees in Florida.

Science, 1935, **81** : 435.

Hevea or Para rubber trees, *H. brasiliensis*, have been introduced experimentally into Florida, and a native, first generation is now in its second year. Susceptibility to cold weather injury seems to be less marked than in "Castilloa" rubber. Young trees need protection from wind, but older ones are relatively hardy. The most normal and rapid growth has been made in pockets of limestone reef formation. Production tests are, however, to be made under many conditions, when it is hoped to employ the factor of selective adaptation, as is indicated in the wide range of diversity shown by *Hevea* individuals.

175. HÜLSEN, G.

633.912-1.8

Die Kautschukkultur in Sumatra. (Rubber growing in Sumatra.)

Ernähr. Pfl., 1935, **31** : 108-13.

The author gives an interesting account of the ousting of tobacco growing by coffee growing and, when the coffee crisis arose about the end of the nineteenth century, of the overthrow of coffee by rubber, represented by *Hevea brasiliensis*, which made its entry into Sumatra in 1900. The so-called "boom" years were 1908-1910, when fantastic prices were paid for worthless land. In 1902 some 435 acres were planted with rubber. In 1907 this had risen to 16,791 and in the following year had nearly doubled again. At the present day over 543,000 acres are under rubber in Sumatra. The plantations are mainly on the red, volcanic hill soils and on the grey, alluvial loam or clay soils. Leaf growth is better on the former, resulting in better water conditions in the plant and hence better latex supply. It may be noted that the Dutch American Company, whose plantations are on the inferior of the two types of soil, appear to have got over the difficulty by the use of ammonium sulphate. The use of other manures remains as yet unproved, but it seems likely that, as the roots reach out and food material becomes scarce, a definite need for potash may arise. It is suggested also that the incidence of such diseases as "mouldy rot" and "fusarium", which have made their appearance on older trees, may be in part due to nutrient deficiencies. Experiments tend to show better results from a leguminous cover crop than from clean weeding, and this practice is gradually being adopted. These crops are not ploughed in, their chief merit lying in the suppression of undesirable weeds and in the surface mulch formed by them. Such a covering is rich in nitrogen, but deficient in potash and phosphate, and it would seem likely that its continued use will necessitate the addition also of potassic and phosphatic nutrients. The particular aim of manurial programmes of the immediate future will be to preserve the yield of good old plantations at a high level, to ensure a healthy bast renewal after tapping, and to render and keep the trees adequately resistant to disease.

176. ESMANS, F. 634.1/7
 La culture des arbres fruitiers au Kenya. Espèces à feuilles caduques.
 (Fruitgrowing in Kenya. Deciduous varieties.)
Bull. agric. Congo belge, 1935, 26 : 499-516.

The author made a tour of the fruit growing districts of Kenya and records his impressions. *Plum*. The Japanese plums grown in the newer commercial orchards have been reduced to about four, in order of importance Santa Rosa, Wickson, October Purple and Methley. These, maturing at different times, cover the period October to March. The rootstock used is myrobalan imported by South African nurserymen as year-old plants and re-sold to Kenya nurserymen, who, the author states, appear to act merely as forwarding agents for South Africa in connexion with the supply of commercial fruit trees to local growers. Peach stock is occasionally used for Japanese plums. The life of these trees is about 30 years. *Peach*. This is obviously the fruit which is best suited to the country, but varieties which will travel well are essential. The best in this respect are Alexander Jewel, Florida Crawford, Hall's Yellow and Mamie Ross. The stocks used are seedlings of the wild peach which is common in the east of the Colony at an altitude of 4,800 ft. Fruit thinning when the fruit is the size of a hazel nut is practised in order to obtain fruit large enough to be sold singly by the retailer. The author thinks the trees ought to be pruned when in blossom in order to reduce the excessive crops. The trees last in good condition for about 25 years. *Apple*. This grows well at altitudes of 5,700-6,900 ft. or higher, if the atmospheric humidity is not too great. The heaviest soil available should be selected. The tested varieties now planted are King of Tompkins County, Cleopatra, Ohenimuru, Jonathan and Rome Beauty. The rootstock is always Northern Spy raised by means of root-cuttings. Some form of basic phosphate applied to the soil is indispensable, African soils being totally lacking in this respect. *Pears*. The most suitable altitude seems to be about 6,000 ft. The most largely planted varieties are *Kieffer Hybrid* and *Le Conte*. Williams Bon Chrétien is also used but not with entirely satisfactory results. Seedling pear is the usual stock used, but as quince grows well on non-calcareous soils at these altitudes, it should be given a trial. Catch crops to give some return while young orchards are maturing consist of pyrethrum and plants that give valuable essential oils such as geranium, peppermint and lavender. Details of the cultural methods used in the orchards are given.

177. COOK, O. F. 634.39
 The Maya breadnut in southern Florida.
Science, 1935, 82 : 615-6.

The breadnut, *Brosimum alicastrum*, a relative of the true breadfruit, *Artocarpus communis*, and *Achras Zapota*, or *A. chicle*, are discussed as regards their association with and utilization by the Mayas. Native bread is made from the nuts of *Brosimum*, and its leaves are used for forage or fodder, a point which may prove significant, if the tree becomes established in southern Florida, where tropical conditions make the feeding of dairy cattle a difficulty.

178. STEPHENS, S. E. 634.39
 Some tropical fruits. 4. The breadfruit.
Qd. agric. J., 1935, 44 : 778-80.

The breadfruit, *Artocarpus communis* Fost. or *A. incisa* L., is generally regarded as a native of Malaya. Two distinct types are found, the seedless and the seeded. The flesh of the latter is rarely eaten, but the seeds, when roasted, make a palatable nut. Tropical conditions are essential, and the best growth is obtained on rich, deep soils with good drainage, but ample moisture. Propagation of the seedless type is facilitated by the production of suckers wherever a shallow root protrudes above the soil surface. Although introduced into Queensland 30-40 years ago, the breadfruit has never become popular and is rarely encountered. This is considered unfortunate, because apart from the value of its fruits it is itself a very ornamental shade tree.

179. SEIN, F. 632.77 : 634.441 + 634.421
Heat sterilization of mangoes and guavas for fruit flies.
J. agric. Univ. Puerto Rico, 1935, 19 : 105-15, bibl. 3.

A series of tests under Puerto Rican conditions was made of the method of heat sterilization used in parts of the U.S.A. to destroy fruit flies. The mango variety "mango blanco" or white mango was chosen because of its susceptibility, and two varieties of guava, a sweet and a sour, were used in the trials. It was found that sterilization at 43°C. for 8 hours in a moist circulating atmosphere killed all eggs and maggots of the two species of *Anastrepha* concerned, and also any pupae outside the fruit. This applied equally well when the mangoes were crated, wrapped or unwrapped. Experiments in which the period of sterilization was reduced to 4 hours also resulted in 100% mortality of the mango fruit fly, and thus an 8-hour period allows a wide margin of safety. It is pointed out that susceptible varieties of mango would, of course, be unsuitable for export because of the dead maggots inside the fruits and the decays which rapidly develop in their proximity. Immune varieties of mango, which have been sterilized as an added precaution could, however, safely be admitted into the U.S.A.

180. STEPHENS, S. E. 634.442
Some tropical fruits. 3. The vi apple or hog plum.
Qd. agric. J., 1935, 44 : 625-6.

"Vi apple" and "hog plum" are the names commonly used in Queensland for *Spondias cytherea* (syn. *S. dulcis*). In Ceylon it is known as "ambarella", in Jamaica as "Jew plum", and in some other places as "Otaheite apple", a name also used for the Malay apple. The tree is a native of Polynesia, requires a tropical climate, and thrives best on deep, rich, scrub lands. A limited number of trees are to be found in N. Queensland, where the fruit ripens between May and July. Fruit fly in the earlier fruit and flying foxes are the only pests noted to cause much loss. The fruit from selected specimens is pleasing for dessert, or jam and jelly making, but many seedlings are very inferior. Although reported elsewhere to be difficult, propagation from seed in Queensland appears to be fairly simple, but the author considers that vegetative propagation is necessary when it is desired to perpetuate good characteristics. In some places the vi apple is budded or grafted on the mango.

181. STEPHENS, S. E. 634.471
Some tropical fruits. 1. The mangosteen.
Qd. agric. J., 1935, 44 : 346-8.

The mangosteen, *Garcinia Mangostana*, is a native of the Malay peninsula, but various attempts to introduce it into Australian cultivation have ended in almost complete failure. Hence very few trees are to be found in Queensland, although another introduction allied to the mangosteen, the Cochin-goraka, *G. Xanthochymus*, proved easy to acclimatize and is often mistaken for it. In addition there appear to be three indigenous species of *Garcinia*, *G. Mestoni*, *G. Warrenii*, and *G. Cherryi*. The principal characteristics of each of these types are described briefly. The mangosteen itself requires a moist, but well drained loam. High atmospheric humidity does not appear to be essential, but temperatures should be rather high, and temperatures below 50°F. have a definitely adverse effect, especially with young trees. Poor root development appears to be one of the major factors in failure to establish the plants, and it is thought that working on to roots of harder species may overcome the trouble. Work in the U.S.A. with several species has had promising results.

182. STEPHENS, S. E. 634.573
Some tropical fruits. 2. The cashew nut.
Qd. agric. J., 1935, 44 : 488-9.

The cashew, *Anacardium occidentale*, is a native of tropical South America, but in Queensland, although there are a few vigorous trees of 20-25 years old, the nut is unknown in local markets. Two well-known allied, indigenous species are the Burdekin plum, *Pleiogynium Solandri*, and

the tar tree, *Semecarpus australiensis*. The cashew is simple to grow, but dislikes being transplanted, and the seed is normally sown in the permanent site. Under favourable conditions bearing starts at about 3 years. In soil requirements it is not fastidious, but prefers sandy soils. It does best under rather drier tropical conditions, and will not tolerate frost.

183. DE JONG, W. H. 634.573
 Cultuur de djamboe monjet in de districten Gempol (res. Malang) en Modjosari
 (res. Soerabaja). (**Cultivation of cashew nut in certain districts in Java.**)
Landbouw, 1935, 11 : 21-5.

The districts in Java in which the cashew nut (*Anacardium occidentale* L.) is mostly grown are mentioned, and the soils briefly described. The total number of trees is roughly about 55,000. The tree appears to flourish in districts with a very low rainfall (for Java). Some of the trees are very large and probably about 30 years old. Propagation is effected by seed which is sown in the rainy season, two seeds to a hole. Adventitious trees which spring up from fallen fruits are also made use of. Of subsequent systematic upkeep there is none. Under these conditions the trees begin to bear in the third to the fifth year after sowing. Flowering begins in March and the fruit is ready for picking 4-5 months later. The fruit is gathered singly by hand. Only the nut is of commercial use, those from prematurely fallen fruits being also carefully gathered up and sold. A tree of average size will carry about 400 fruits. The wood is of little value but can be used in charcoal burning. The trees are sometimes attacked by a caterpillar at the flowering season, and while in fruit suffer from birds and various small mammals.

184. BADAMI, V. K. 634.58
***Arachis hypogaea* Linn. Groundnut or peanut.**
J. Mysore agric. exp. Un., 1935, 15 : 141-54.

This article traces the original habitat of the groundnut and discusses its distribution in the world. Arguing from a most interesting series of references to the earliest mentions of groundnuts in literature, the author is able to show with every degree of probability that the original habitat was Brazil, where a number of species of *Arachis* are still to be found in their wild state. Eastwards from Brazil he traces its spread via Senegal and Gambia to the upper reaches of the Niger and along the coast of Africa to Angola. From the mouth of the Niger it moved to Lake Tchad, Dafur and the Sudan via Haussaland, from the Sudan to Egypt, Eritrea and Uganda. Westwards from Brazil it spread to Peru where it was found in cultivation by the first European invaders. In 1519-21 it was carried by the Magellan expedition across the Pacific to the Moluccas and Philippine Islands. From the Philippines to Indo-China, China and thence to Japan. From the Moluccas it went to the Malaya Archipelago and the east coast of Australia. Also from these islands or China it reached the Malay Peninsula, Siam, Burma, Bengal, and the east coast of South India, where by 1800 it was in cultivation even in interior districts. From the Malayan Archipelago it was carried to Ceylon on one side and across the Indian Ocean to Madagascar and Mozambique on the other. From Mozambique it spread up and down the east coast of Africa, and in 1800 to the west coast of India. The opening of the Suez Canal and the exploitation of the oil by the French oil trade gave a great stimulus to cultivation in India and has built up the prosperity of such ports as Madras, Pondicherry and Cuddalore. In South America the groundnut spread to Peru, Argentine and Guiana and from Guiana to the West Indies. Introduction to North America was in slave ships from West Africa. At the present day its most important centres of cultivation are U.S.A., India, Senegambia, French Sudan, Nigeria and China. Consumption is said to be increasing and prices mounting. Among its manifold uses are the employment of its oil in the manufacture of soaps, margarine and so-called olive oil. The oil cake is becoming increasingly popular for fattening stock or feeding milch cattle, and being rich in nitrogen has a manurial value which is much appreciated by the market gardeners round Paris.

185. BEIRNAERT, A. 634.6 : 581.144.1
 Introduction à la biologie florale du palmier *Elaeis*. (**Floral biology of the oil palm.**)
Rev. Bot. appl., 1935, **15** : 1091-1108.

A detailed study of the inflorescence of the oil palm (*Elaeis* spp.). Numerous drawings accompany this article.

186. ESTRADA, M. 634.62
 El datilero. (**The date palm.**)
Rev. B.A.P., 1936, **18** : 219 : 9-14.

The possibilities of establishing the date palm in the Argentine on commercial lines are discussed. From time to time palms have been imported but their subsequent behaviour has been erratic. Some have died out, others have not fruited sufficiently well to merit further consideration and the production of offsets suitable for propagation has been meagre. The author, however, is convinced that certain districts of the Argentine are capable of supporting profitable date plantations, in particular in the province of San Juan, and small experimental plantations with plants imported from California are now being laid out. The Alto de Sierra Experiment Station will be in charge of them.

187. SCHAFFNER, J. H. 634.651 : 581.163
Artificially induced parthenocarpy in *Carica Papaya*.
J. Hered., 1935, **26** : 261-2.

All the large leaves of a solitary, vigorous, carpellate papaw plant growing in a greenhouse in Ohio were cut off. The formation of abscission layers in the flowers due to lack of fertilization was immediately stopped, and parthenocarpic fruits developed to a considerable size. Examination showed that no development of embryo or endosperm occurred, thus indicating that the stimulus causing the inhibition of the abscission could not have been in the nature of a hormone derived from these sources. It is therefore concluded that the induced ectogeny and subsequent parthenocarpy may have been caused entirely by stimuli produced by charged osmotic pressures resulting from the reduced leaf area.

188. TRAUB, H. P., AND OTHERS. 634.651 : 581.192
Latex test for maturity of papaya fruits.
Science, 1935, **82** : 569-70, bibl. 2.

A milky juice is exuded when immature fruits of *Carica Papaya* are punctured. As the fruits mature the juice gradually becomes colourless, until finally it ceases to exude. There are indications that juice colour may be used as a maturity test, the best time to pick being when it has become almost or wholly colourless. Fruits picked earlier are inferior, and later possess poorer keeping quality.

189. CHEVALIER, A. 634.771
 Les variétés de bananiers du groupe *Cavendishii*. (**Varieties of Cavendish banana.**)
Rev. Bot. appl., 1935, **15** : 573-80, bibl. 6.

This paper consists of a classification of the mutations and hybrids of the Cavendish banana. For the information given the author is largely indebted to the work of Cheesman and of Kervegan.

190. JACK, H. W. 634.771/3
The banana industry in Jamaica.
J. Jamaica, agric. Soc., 1935, **39** : 627-39, and 739-49.

The area under bananas in Jamaica exceeds annually 100,000 acres, and the value of the export crop approximates to £2,000,000 though fluctuating widely from year to year. In 1932 this crop

represented 59% of the total exports of the Colony. The production of non-irrigated plantations ranges from 100 to 150 stems yearly, and of the small area of irrigated plantations from 200 to 300 stems. The history of the industry is reviewed briefly. The physical features of the island and the soils of banana areas are outlined, and the author then gives an account of planting, cultural practices, and pruning. Among points noted the direct relationship between small tree size and small fruit and low "count" bunches is stressed. This consideration would appear to govern spacing distances in planting. Pumps for lifting water, and the irrigation of the crop are described. The importance of drainage and its objects are emphasized. Pests and diseases, notably Panama disease and the weevil borer are mentioned, and with reference to the former it is stated that breeding work to produce immune types of quality equal to the Gros Michel is showing encouraging results. Methods of harvesting, shipping, costs of production and marketing are reviewed at some length, and finally an account is given of the operations of the Jamaica Banana Producers' Association Ltd., a well-organized co-operative concern formed in 1929 to promote competition amongst exporting buyers and thus ensure reasonable prices for growers. In 1934 its members controlled about one-third of the bananas produced in Jamaica.

191. JACQUES-FÉLIX, H. 634.771-1.8
Fumure organique du bananier en Afrique occidentale. (**Organic manures
for banana in West Africa.**)
Rev. Bot. appl., 1935, 15 : 506-25.

Cattle manure. The difficulties of procuring this are discussed. The keeping of cattle in West Africa always means a loss to the planter except in so far as their manure can be used for the banana plantations. It is, therefore, a point to be carefully considered. Assuming, however, that manure is available it should be applied after the resting season at the rate of 30-60 tons per hectare (1 ha. = 2.47 acres) spread over the entire surface and not just round the plant. *Dry mulching* or covering the soil with a bed of vegetable litter (but avoiding contact with the banana stems for fear of fungal infection) conserves the moisture, adds humus to the soil, and keeps down weeds. Its action is largely mechanical and is equally beneficial on irrigated or unirrigated lands. The litter can be composed of grasses, for an adequate supply of which an area at least 4 times the size of the ground to be mulched will be required, or of the smaller branches of trees and shrubs. Under West African conditions these are often easier to obtain. An alternative method to spreading the litter is to pile it in long heaps between the banana rows keeping it in place by stakes. Some planters prefer to dig the mulch in just under the surface. This is a good cultural practice, provided that only decomposed litter is so treated. To dig in green litter leads to considerable denitrification of the soil. Cover crops of leguminous plants, later ploughed in, are useful as increasing the nitrogen and humus of the soil but as regards the other nutrients and some of the nitrogen they merely borrow them, as it were, from the soil and return them later in organic form, thereby at least preventing their being leached out in the meantime. *Crotalaria Calopogonium* makes a good cover crop under the plantation while *Tephrosia candida* may be grown outside the plantation and be cut and carried in for use as a mulch. Methods of making organic manure artificially, e.g. by the use of Adco, are described. Sea bird guano, bat droppings from caves and fish manure are favourably mentioned. A list of grasses which are suitable for growing as mulch is given. These are classified according to the soils on which they grow best.

192. MAGEE, C. J., AND EASTWOOD, H. W. 634.771-2.4
Corm rot of bananas.
Agric. Gaz. N.S.W., 1935, 46 : 631-2.

With the extension of banana planting in N.S.W. to hardwood forest lands corm rot (syn. dry, stump or root rot) has become of more importance, because it is primarily a disease of plantations on recently cleared land. A number of distinct fungi of the mushroom type have been isolated from diseased corms, one of which is a species of *Clitocybe*. Suggested control measures include the removal of infected stools including any apparently healthy plants, to be chopped up and burnt, the holes to be left exposed to sun and air. Replanting is inadvisable, but if done, the

new hole should be dug some feet away from the infected site. Where new plantings are being made, it is desirable to remove all roots and stumps from the neighbourhood of each set by digging larger holes than usual.

193. MAGEE, C. J.

634.771-2.48

***Cercospora* leaf spot of bananas.**

Agric. Gaz. N.S.W., 1936, 47 : 30-2.

The disease is described and illustrated. Leaf spot is most destructive in N.S.W. in plantations with southerly or south-westerly aspects, or at altitudes exceeding 1,000 ft. or on unfertile or overcropped soil. The choice of a suitable site, cleanliness in the plantation with all dead and damaged leaves removed and weeds kept under control, and a maintenance of the plants in healthy growth by manuring, including cover cropping, are the most likely methods of avoiding in some measure the attacks of leaf spot.

194. HANSON, A. P.

634.774

Pineapples.

J. Jamaica agric. Soc., 1935, 39 : 641-3.

The pineapple industry of Jamaica lags behind those of some other West Indian islands, but interest in the crop, particularly for export, has recently been aroused. This paper contains instructions on a number of points of interest to growers, among which are the following :—*Climate*, the pineapple is not exacting and can be grown from sea level up to about 2,500 feet. It will withstand considerable drought, but for satisfactory results requires a fair amount of moisture. Plants may, however, be killed by overwatering. *Soil*, preferably light and well aerated. With careful cultivation pineapples can be produced on soils too poor for other crops. *Shade* is harmful. Decayed matter lodges in leaf axils and encourages infestation by the pine weevil borer. *Propagation*. Slips, located at the base of the fruit, may be grown in the nursery till 12"-18" high before planting out, but suckers of about the same size, originating in lower leaf axils, produce the best plants. Ratoons from the rootstock are also satisfactory. *Planting suckers*. Before planting, strip off the outer leaves, which prevent the roots protruding, and untwine and trim the roots. Never cut off the inner leaves of the sucker. Planting may be done on the flat, on ridges, or on beds. *Spacing*. Wide spacing allows the developing fruits to bend over and become misshapen. A satisfactory method is to plant pineapples in groups of four rows which are 4' apart, the plants in the rows being spaced 2' × 2', giving 8,000 per acre, or 2½' × 2½', giving 5,000. *Cultivation* consists in keeping the land free from weeds, and mulching. *Maturity*. Good suckers mature in 12-18 months. *Manuring*, if heavy, spoils fruit quality. *Local varieties* :—Red Spanish, a good export type ; Jamaica Sugar Pine, the most popular local variety, but not a good shipper ; Ripley ; Jamaica Black, a variety which should be encouraged for export ; Sugar Loaf ; and Sam Clark.

195. SAYED, I. A.

634.774 : 575.255

Chimera in pineapple.

Poona agric. Coll. Mag., 1935, 27 : 124-8.

The morphological characters of a pineapple plant, which is considered to be a periclinal chimera, are described. In vegetative characters it appears to have arisen from the variety Queen, but the fruit provides a clear indication of its source from the Kew pine (Smooth Cayenne). Distinguishing features between these two varieties and the bud-sport are detailed. Suckers produced by the plant are to be the subject of further study.

196. CHEVALIER, A.

635.952.2

Les îles du Cap Vert. (Cape Verde Islands.)

Rev. Bot. appl., 1935, 15 : 733-1090.

A very full and interesting account of the geography, animal and plant ecology, agriculture and flora of the Cape Verde Archipelago.

197. WALKER, A. 635.952.2
A propos de plantes utilisées par les Noirs du Gambon. (**Plants utilized by the natives of the Gambia.**)
Rev. Bot. appl., 1935, 15 : 94-103.

A long list of native names is given, not only for the plants themselves but for various parts of the plant or for different stages of its growth. Notes are then given of the different uses to which these plants are put.

198. BRITISH GUIANA, DEPARTMENT OF AGRICULTURE. 635.1/7
Hints on vegetable growing.
Agric. J. Brit. Guiana, 1935, 6 : 128-54.

The cultivation of a large number of vegetable crops under local conditions is described. Varieties are listed with their chief characteristics. The control of the more important insect pests and diseases is outlined, and notes are included on factors influencing quality, and on seed storage and supplies.

199. LEFÈVRE, P. 635.23 : 632.8
Quelques considérations sur le mosaïque du manioc. (**Cassava mosaic.**)
Bull. agric. Congo belge, 1935, 26 : 442-7.

Cassava (*Manihot utilissima*) is a native of Central America. The mosaic disease is stated by the author to be essentially an African one, though five years ago it appeared in Java on plants which had been imported from Central America. Plants affected by the disease show pale green streaks in the young leaves, spreading outwards from the base of the leaflets, and persisting and increasing as the leaves mature. The affected leaves show considerable abnormality of growth. Apart from the fact that the disease would naturally be spread by propagating from cuttings of infected material, a white fly, *Bemisia gossiperda* var. *mosaicivectura* Ghesq. (*Aleurodidæ*), has been proved to be an active vector. Control measures are discussed. At the Karuzi Experiment Station, Belgian Congo, a top dressing of ashes was ineffective on young plants already showing the disease, but similar plants which received a good dressing of a well balanced fertilizer could be very favourably contrasted with the controls. From indications which have appeared in the course of research it is thought that it should not be difficult to breed immune varieties. The effect of the disease on the yield is to reduce the diameter of the tubers by about one-half. Sweet cassava suffers more than bitter.

200. PORTÈRES, R. 635.34
Sur une nouvelle variété de chou cultivée par les Dans de la Côte d'Ivoire.
(**A new cabbage grown by the Dans on the Ivory Coast.**)
Rev. Bot. appl., 1935, 15 : 1120-1.

The variety in question from the mountainous district of Man has been compared with the other cabbages grown by the natives in North, East and West Africa and has been found to differ from them. The differences have been maintained under experimental cultivation in Europe. This cabbage bears most affinity to *Brassica integrifolia* O. E. Schultz. It has now been named *Brassica integrifolia* (West), O. E. Schultz var. *Chevalieri* nov. var.

STORAGE.*

201. HARTLEY, SIR HAROLD. 656.2
The transport of food by rail.
J. Soc. chem. Ind., Lond., 1935, 54 : 690-8.

Recent developments in the transport of foods by rail in Great Britain, including amounts conveyed, the construction of vehicles, and methods of refrigeration, are outlined. The application of these developments to various agricultural products and to fish is described, but reference

* See also 25.

is also made to the transport of bananas and of strawberries for canning. Strawberries coming from the field without pre-cooling, and at a temperature of 60° to 80°F., were placed in insulated vehicles employing solid carbon dioxide as the refrigerant. After travelling overnight, wastage at the factory was only 10%, which is the recognized permissible wastage in locally grown fruit. In cooling, contact between the fruit and CO₂ gas was normally prevented by excluding the gas from the container, but on one occasion, when considerable leakage occurred, a subsequent examination of the fruit some months after canning failed to reveal any ill-effects due to contact. The system of heating vans for the transport of bananas is outlined briefly.

202. COPISAROW, M. 664.84 + 664.85
A new method of fruit and vegetable preservation. The metabolism of apples.
J. Soc. chem. Ind., Lond., 1935, 54 : 283, bibl. in text.

Preliminary experiments have indicated that solutions and suspensions of maleic acid in ethereal oils sprayed on to potatoes inhibit sprouting, and on to apples and pears enhance their keeping properties considerably, mould being eliminated and decay greatly reduced. Fumaric acid and an aqueous solution of maleic acid both proved ineffective. It is suggested as not improbable that maleic acid is actually produced during the metabolism of apples, and is intimately connected and perhaps identical with the germination-inhibiting substance. The important changes in the apple during the maturity to senescence period may be associated with the degradation of maleic acid to ethylene through the influence of modified enzymic activity. It is demonstrated how a quantitative link between ethylene and maleic acid may be obtained, which supports this conception, and to some extent explains the failure, hitherto, of detecting the transitory traces of maleic acid in apples.

203. KIDD, F., AND WEST, C. 664.85.035.1
The gas-storage of fruit : a warning note.
Sci. Hort., 1936, 4 : 75-8, bibl. 8.

The more important advantages of gas storage are :—increased life of fruit in store, avoidance of trouble from low temperature breakdown owing to higher temperatures possible, retardation in colour change in fruit, preservation of hardness in fruit, increased life of fruit after removal from store. Thanks to previous careful laboratory experiments fruit growers are now able to enjoy these advantages. The authors here give a grave warning against extending the methods in use to products, whose behaviour under gas storage conditions has not been thus experimentally surveyed. Their reasons are as follows :—(1) CO₂ in certain concentrations may produce definite hidden injurious effects in fruit, which are not visible until the consumer tries the fruit ; (2) the point where the concentration ceases to be beneficial and starts to be harmful varies with the kind, variety and state of the fruit, as also on temperature and concentration of O₂ in the air. [A table is shown of temperatures and atmospheres found injurious to four named apple varieties under varying gas conditions.—ED.] ; (3) the germination and spread of rot-producing fungi is markedly influenced by CO₂ and O₂ concentrations and temperature ; (4) it is dangerous to store more than one kind of fruit together or even different varieties of the same fruit or even the same variety at different stages of ripeness owing to the production of volatile products by the fruit concerned and their far-reaching effects. Gas storage of any product on a commercial scale should always be preceded by thorough tests. In reply to a number of queries on the point the authors state with confidence that at carrying temperatures of 34-36°F. percentages of 4-5% CO₂ would probably be beneficial rather than harmful to apples.

204. ESBJERG, N. 664.85
 Orienterende oplysninger om Frugtopbevaring. (**Fruit storage.**)*
Andelsbogtrykkeriet i Odense, 1934, pp. 40, 24 illustrations or plans.

This booklet is primarily intended to show the Danish fruit grower the advantages of storing fruit and the methods available nowadays. The first few pages are devoted to ventilated storage

* Full translation available.

in the U.S.A. A detailed account is next given of ventilated stores at Blangsted Experiment Station and of three co-operatively or privately owned modern ventilated stores. A note showing the surprising growth of cold storage in the U.S.A. is followed by a full account of the Blangsted Experiment Station cold store. This was installed in 1917 and the technique employed is explained. Notes are given how this technique has of late years been greatly improved and notes are given of five modern stores erected in the last few years with capacities ranging from 10 tons of fruit to 400 tons. Finally, figures are borrowed from different Danish communications showing the effects of various cultural practices on the keeping quality of apples, of different storage temperature including ventilated storage on apples, pears and plums, and of the precooling of strawberries.

205. YU, T. F. 664.85 : 632.4
Notes on the storage and market diseases of fruits. 1. [English-Chinese summary.]

Contr. Pl. Path. Lab., Bot. Dep. Univ. Nanking, **25**, 1935, pp. 12.

The author mentions about 27 different fungus organisms causing rots of fruit in storage. In each case the fruit sp. or spp. from which the organism was isolated are noted, and in a number of cases the symptoms of the rot and the organism itself are described.

206. CARNE, W. M. 664.85.11 : 634.11
The relationship of crop size to the keeping of apples.
Fruit World, Melbourne, 1935, **36** : 12 : 9.

There is evidence that the differences between light and heavy crops in the same season are on most points the same differences as are found between similar crops in poor and good keeping seasons. Investigations with several varieties have given such consistent results that it is thought the observations made here will probably apply to all varieties in greater or lesser degree. While on the tree light crop fruit from susceptible varieties is more affected by water core, tree pit or cork, or hollow core. Later in storage it is more susceptible to rots, storage pit, premature breakdown and loss of firm texture, but is less susceptible to Jonathan spot. Recommendations based on the evidence to date are that light crop fruit should be picked early, and should never be packed with, or in the same line as good to heavy crop fruit. Very light crop fruit of varieties like Jonathan, which are subject to wastage, and moderately light crop fruits of varieties like Cox's Orange Pippin, Ribston, and Cleopatra, especially from orchards where pit has been troublesome, should not be exported or stored. With Cox, and probably Ribston, good crops in alternate years appear to be preferable to moderate crops each year, provided the off-year crop is not stored or exported. Experiments have shown that keeping quality is good from good crops, moderate from moderate crops, and poor from light crops.

207. TILLER, L. W. 664.85.11.037
Cold storage of Cox's Orange.
N.Z. J. Sci. Tech., 1935, **17** : 536-40 and *N.Z. Orchard*, 1935, **8** : 15-7.

The paper reports the results of two small exploratory tests on the storage of Cox's Orange Pippin, in a year of very light crop in New Zealand. I. One bushel case each of Extra Fancy, Fancy, and Good grades were picked and stored at a temperature of 38° F. to 40° F. on February 22nd for 11 weeks. They were then removed to room temperature, 55° F.-65° F., for 2 days before examination. Fruit and especially large fruit from light crop trees showed very poor keeping quality. Highly coloured fruit of Extra Fancy grade showed the greatest susceptibility to water core and therefore to subsequent internal breakdown, but was comparatively free from bitter pit. Green Good grade fruit from the shaded parts of the tree was particularly susceptible to bitter-pit but not to watercore. Apples on the exposed parts of the tree showed high flesh temperature and this appears to be a contributory factor in inducing water core, though the respective parts played by heat and light are still unassessed. II. It was desired to discover whether the equivalent of prolonged heavy rainfall during the six or seven weeks preceding picking would influence field pitting or storage bitter pit. Two somewhat small Cox's Orange trees, one bearing very

light and one a fairly heavy crop were given seven weekly irrigations from January 5th each equal to $2\frac{1}{2}$ inches of rainfall, or a total of 15 inches of rain, this being augmented by a natural rainfall of 3.61 inches. There had also been a fall of 3.19 inches during the 10 days previous to the first irrigation. The prevalence of pitting on the tree was not increased by irrigation. The fruit when picked was stored for 3 months under identical conditions with non-irrigated fruit. Susceptibility to internal breakdown and bitter pit in cold stored fruit from trees carrying a crop of given size was not modified by irrigation. The fruit from the light crop irrigated tree showed much more severe bitter pit than that from the heavily laden irrigated tree but less breakdown, this being due primarily to relatively low incidence of water core.

208. CARNE, W. M., AND MARTIN, D. 664.85.11.035.1

Apple investigations in Tasmania : miscellaneous notes. 7. The safe limit of carbon dioxide concentration under ordinary cool storage conditions.

J. Coun. sci. industr. Res., Aust., 1935, 8 : 271-6, bibl. 6.

The effect of carbon dioxide gas concentrations was studied in 3 varieties of apple during 1934 and 1935. The apples were placed in air-tight tins in which CO_2 was allowed to accumulate to a pre-determined level at $50^{\circ}\text{--}60^{\circ}\text{F.}$, and was subsequently kept constant at various concentrations by blowing air in daily. The tins were then placed in a commercial cold store, in which the mean temperature was kept at 34°F. during the first year tests and at 32°F. during the second. Records were kept of the incidence of low temperature breakdown, brown heart, and alcoholic poisoning, and these are tabulated in detail. Of the three varieties tested French Crab proved the most, and Jonathan the least susceptible to both brown heart and alcoholic poisoning, with Sturmer intermediate. Slight injury occurred to French Crab with CO_2 concentrations under 3% and to Sturmer under 6%, but none was found in Jonathan under 8%. In general, however, the best results in respect of ground colour and freedom from injury after 8 weeks storage were produced by 2-3% CO_2 , and for the period of storage usually required for apples shipped overseas a concentration of 2% CO_2 and a temperature of 32°F. would seem to be desirable.

209. CARNE, W. M., AND MARTIN, D. 664.85.11 : 632.1

Breakdown in Tasmanian apples.

J. Coun. sci. industr. Res., Aust., 1935, 8 : 265-70.

This paper gives a condensed account of the more important results obtained so far in a study covering several years of non-parasitic wastage in Tasmanian apples. Nine varieties have been used in the investigation, but of these Cox's Orange Pippin has been studied more intensively than the others. The term "over-ripeness" is often used to denote breakdown, but in the opinion of the authors true over-ripeness is much less serious than is sometimes suggested, and is commonly mistaken for breakdown taking any of three forms, low temperature breakdown, bitter pit, and water-core. Susceptibility to all three is, other things being equal, highest in fruits from trees carrying the lightest crops. Susceptibility varies to some extent with soils, depending mainly, however, on physical characters such as root depth, water penetration, drainage, etc., and very little on chemical factors. For any one tree the more mature the fruit is when picked, the more liable is it to breakdown. Likewise larger fruits are more susceptible than small ones on the same tree. Liability to low temperature breakdown is greatest in seasons of relatively low summer temperatures. Storage at $32^{\circ}\text{--}34^{\circ}\text{F.}$ for varieties subject to this complaint is always inadvisable. Following cool summers 38°F. seems to be the minimum safe temperature. Susceptible and resistant varieties are listed. The latter are characterized by a relatively low level of titratable acidity. Seasons favouring relatively high acidity, high soluble carbohydrates content, and slow rate of starch loss favour susceptibility. The following recommendations are made for reducing wastage in Tasmanian apples shipped overseas or stored locally. 1. Apples should be picked, stored or shipped in relation to the varieties concerned, their liability to breakdown, the crops on individual trees, and climate during the season in question. 2. Fruit of very susceptible varieties such as Cox or Ribston from light crops should be neither shipped nor stored, but marketed locally immediately. 3. In cool summers crops from susceptible varieties should be picked as early as possible. 4. Varieties subject to

water-core should be picked before this disorder is manifested, light crops being picked before heavy. 5. Following cool seasons varieties resistant to low temperature breakdown should be segregated in store from those which are susceptible, so as to permit the use of higher temperatures for the latter. On ships this may be difficult, but, where separate chambers are not available, the warmer parts of the hold might be utilized for susceptible varieties.

210. GREGORY, J. H. 634.11-2.1
Water-core in apples.
Qd. agric. J., 1935, 44 : 748-50.

The effect of storage on water-core was studied in Granny Smith, Delicious and Dunns apples. Affected specimens were placed in ordinary store for 21 days in which temperatures rose to a maximum of 76°F., and in cold storage at 34-35°F. for 155 days. In both cases samples of sound fruit were included as checks. Examination at the end of each period revealed that neither method of storage had exerted any appreciable influence towards eliminating water-core. From field observations it is thought that the best course would be to leave the fruit hanging on the tree for as long as possible, since apples, not unduly affected, tend to recover naturally in 2-3 weeks. It is hoped to conduct further tests during the coming season.

211. TINDALE, G. B., AND TROUT, S. A. 664.85.13
The cool storage, handling and ripening of pears.
Orchard N.Z., 1935, 8 : 8 : 9-11, reprinted from *J. Dep. Agric. Vict.*, 1934, 32 : 38-40.

Experiments on the cool storage and transport of pears were started in 1932, and are still in progress. The present paper summarizes the information obtained to date with particular reference to the Williams variety. For this pear the optimum ripening temperature lies between 55° and 65°F., and trials have shown that, if the fruit is picked when hard, dark green, but of export size, and stored immediately at 32°F., it will ripen normally after a period of up to 12 weeks at the above temperature range. Stored at 32°F. for longer periods it will not ripen at any temperature, but will become mealy and devoid of flavour. Core breakdown and scald develop after approx. 20 weeks' storage. Colour changes are a valuable guide. From dark green the fruit in cold store turns to light green, then to greenish yellow, and finally to yellow. The first appearance of yellow marks the end of storage life. The factors influencing storage life are :—(1) Picking, to be done when hard, dark green, and of export size. (2) Pre-cooling. Pears after picking ripen quickly, especially in warm weather, and may become fully ripe in about six days, unless subjected to immediate cooling. (3) Packing should follow pre-cooling and not vice versa, because to pack first means a delay in cooling, secondly wrapped and packed fruits cool down more slowly, and thirdly fruit after cooling shrinks and if packed first may become loose in the cases. (4) Transport. The fruit should be removed from cool store in an iced truck and re-stored on the ship at 30-32°F. without delays on the wharf. Accurate control of temperature is essential, the freezing point being 28-29°F., and the length of storage life being halved at 36°F. (5) Marketing. Facilities for ripening pears at the optimum temperatures should be improved both in England and Melbourne. (6) Variety. Although the figures quoted apply primarily to the Williams pear, the same principles can be applied to other varieties.

212. TINDALE, G. B., AND OTHERS. 664.85.22.037
The cool storage of plums. First progress report.
J. Dep. Agric. Vict., 1935, 33 : 552-4.

From experiments conducted at Melbourne on the cool storage of plums the following conclusions have been drawn :—(1) Plums in general have a limited storage life, and for export overseas only those varieties which can be held for a reasonable time should be considered. The storage lives of the varieties used in the investigation, when picked immature and promptly stored at 31°F., were Wickson 5 weeks, October Purple and Ballena 6 weeks, Satsuma, Narabeen, President, Grand Duke and King Billy 7 weeks, Lawford Gage 8 weeks, and Golden Drop 8 to 9 weeks. Thus the European varieties on the whole have a longer storage life than the Japanese varieties.

(2) Plums for storage should be picked when fully grown, but still definitely immature. (3) Prompt pre-cooling to 31°F. should follow picking, and the fruit should then be packed and shipped as soon as possible. (4) The carrying temperature should also be maintained at 31°F. (5) Plums held in store up to the maximum storage life will ripen normally, taking up to 2 weeks at 50°F., but only 4-5 days at 65°F. Plums held for longer than this in store will not, however, ripen normally, but become mealy and/or brown around the stone. (6) Good ventilation in ships' holds is necessary to avoid injurious carbon dioxide accumulation. Experiments with gas storage showed 15% CO₂ to be definitely harmful, while 5% CO₂ reduced storage life by about a week, and 10% by a fortnight.

213. LLOYD, J. W., AND DECKER, S. W.

664.85.25.037

Factors influencing the refrigeration of packages of peaches.

Bull. Ill. agric. Exp. Sta. 418, 1935, pp. 439-64, bibl. 7.

To obtain peaches of the highest quality in flavour, aroma and colour, harvesting must be delayed to within only a few days of the fully ripe stage. The losses at present sustained in transit are very large, but rapid pre-cooling after picking to below 50°F. may greatly reduce these losses. The experiments reported in this paper were designed to determine the factors influencing the rate of cooling with particular reference to the cooling of the fruit after it has been loaded in refrigerator cars. The equipment used and the procedure followed were described in an earlier paper on tests with apples.* The variety used throughout was Elberta, and the straight-sided tub bushel basket with a ventilated paper liner was selected as the standard container in all tests except where packages were being compared. In the first experiment peaches and Grimes apples were packed in a similar manner at about 75°F. and then placed in a cooling apparatus at 34°F. Thermocouples were distributed through the packages in the air spaces and in the centres of fruits in the various rows, and records were taken over a period of 24 hours. Comparing the two fruits it was found that the peaches did not develop as great temperature differences between the outer and centre rows of fruit as did the apples. At the outset the peaches cooled more rapidly than the apples, but after 6-8 hours the latter were cooling at a quicker rate. Peaches were graded into three sizes, 1 $\frac{3}{4}$ "-2" diameter, 2"-2 $\frac{1}{4}$ ", and over 2 $\frac{1}{4}$ ", but size was not found to affect the rate of cooling in the baskets. The use of ventilated paper liners as opposed to no liners in the tub bushel baskets was not found to interfere appreciably with cooling. The lined tub bushel basket commonly used, however, is not ventilated, and compared with an unlined ventilated bushel basket the contents took twice the time to cool to 50°F. The contents of ventilated corrugated bushel boxes cooled at approximately the same rate as those in lined tub bushel baskets. Peaches packed in a lined tub half-bushel basket cooled more rapidly than those in a similar bushel basket. The type of container is thus very important in determining the rate of cooling. It is doubtful if the more rapid cooling rate obtained by omitting a protective liner would outweigh the disadvantages of such a practice, especially for high quality, mature fruit. Liners should, however, be so ventilated with holes as to interfere as little as possible with cooling. The use of oil wraps for peaches materially retards cooling, and the difference between the temperatures of the outside row and the centre of the package becomes much greater than for unwrapped fruit.

214. LEONARD, E. R.

664.85.3

The storage of Trinidad citrus fruits.

Mem. Low Temperature Res. Sta. Trin., 2, 1936, pp. 47, bibl. 34, obtainable

Editor, *Tropical Agriculture*, Trinidad, 2s.

Grapefruit. Under conditions at the Low Temperature Research Station, Trinidad Marsh grapefruit at the end of a battery storage period of five weeks at a temperature of 45°F. with delivery air at the same temperature compared favourably as regards storage behaviour with grapefruit grown elsewhere. If only grid storage is available, chilling will result at this temperature, unless some form of air circulation can be provided. If local pre-cooling is necessary,

* Factors influencing the refrigeration of packages of apples. *Bull. Ill. agric. Exp. Sta.* 410, 1934, H.A., 1935, 5 : 3 : 499.

this should be rapid and the fruit should be shipped as soon as possible. Non-refrigerated transport is practicable but will entail increased fungal wastage and blemish from desiccation. Plantation sanitation has been shown to be of the utmost importance in controlling storage wastage. Fruit from gummosis-infected trees has remained normal in storage but fruit from trees affected by root rot is abnormal. *Oranges*.—*Cocoa orange*, a thin-skinned local variety, dark green when ripe, requires careful handling, reduction of the quailing period to a minimum, and early storage at 45°F. Ethylene colouring is inadvisable owing to wastage resulting from lengthened exposure to high temperatures. *Valencia orange*. Under Trinidad conditions early cold storage at 45°F. will maintain this variety in a condition suitable for export. *King orange*. This variety showed sound keeping qualities and picked green or just yellowing showed no increase in maturity after 27 days at 40°F. Chill effects were absent. *Satsuma oranges* require careful handling, early picking as regards maturity, protection from desiccation, rapid storing at 40°F. after picking, and rapid distribution after removal from cold storage. *Grapefruit in a local commercial cold store*. An appendix records the results of observations on air temperature, humidity, vitiation and flow, flesh temperature and fruit condition in a cold blast, refrigerated store. The stowage plan is described. The rate of cooling was slow, 45°F. air temperature being reached only after 12 days. Relative humidity remained at 85%. Air vitiation was negligible. Air delivery was at the rate of 300 cu. ft. per minute, later reduced to 136 cu. ft. per minute. This completely changed the air in the room every 18 and 40 minutes respectively. Out of 14 crates (1,100 fruits) examined, total wastage from fungal rots was only 1.2% and loss in weight was negligible.

215. PUTTERILL, V. A. 664.85.3 : 632.4
Citrus wastage investigations. Progress report No. 3.* Season 1934.
Bull. Dep. Agric. S. Afr. 149, 1935, pp. 27.

Comprehensive experiments on methods of reducing wastage in citrus fruits have been carried out mainly at Zebediela and Grahamstown for several years.* The data obtained in 1934 are here presented and discussed. These include observations in the packing houses, mould wastage in weekly consignments shipped overseas, a comparison between boxes packed at the beginning and at the end of the day to indicate the effect of the degree of spore contamination, wilting tests, lug-box disinfection tests, a comparison of boxes made from South African and Swedish woods, a comparison between waxed and ordinary wrappers, a dipping test with borax solution and various fruit washing tests, and finally a study of the influence of wasty fruits in a box on waste development in other fruits. Results are largely given in the form of tables, and a few general recommendations are included at the end.

216. NATTRASS, R. M. 664.85.3 : 632.4
Prevention of wastage of citrus fruit in transit.
Cyprus agric. J., 1935, 30 : 84-7.

Green and blue moulds are the two principal causes of wastage in Cyprus oranges shipped to European countries, the amount of rot usually increasing steadily as the season advances. Other fungi do appear occasionally, but are of little importance. Of the two moulds the green is the more serious. Neither can penetrate the healthy skin of an orange, and measures adopted to prevent infection must first aim at avoiding damage to the fruit. The slightest wound or abrasion, particularly if it ruptures the oil vesicles, may permit the entry of rotting fungi. In the orchard the importance of pruning and windbreaks in preventing chafing of branches and twigs is stressed. Punctures made by insects such as scales and fruit fly are likewise possible seats of infection. Care in picking the fruit is very important. To minimize damage caused by finger and especially thumb nails, growers are strongly advised to equip pickers with cotton gloves. In placing ladders and in cutting the fruit with round-ended clippers, every effort should be made to avoid rubbing or knocking the fruit. Wilting for at least four days should

* See also *Idem.*, Progress Report 2, *Bull.* 131, 1934. *H.A.*, 1934, 4 : 4 : 678.

follow picking. The fruit should not be heaped, but placed, not more than two layers deep, on shelves in a well-ventilated shed. Wilting does not remove the need for exercising care in handling, packing and transporting. Promising results have been obtained from trials with disinfectants. The best control of decay was given by Shirilan 1% dip (a proprietary fungicide), and by a cold saturated solution of borax at $\frac{1}{2}$ -minute immersion. Shirilan had no apparent effect upon fruit consistency, but the borax-treated fruit was softer than the control, and although it became firmer later, it did not compare favourably with Shirilan-treated or control fruits. Hot 7% borax for 5 minutes gave inferior control to cold borax, and hot 7% borax for $\frac{1}{2}$ minute gave no control of wastage. In both cases fruit treated with hot borax became softer than fruit treated with cold borax. The impregnation of ordinary wrappers with iodine was tested in another small trial, and preliminary results were again promising. It is hoped that further experiments, both of dips and impregnated wrappers, will be made on a large scale in the near future.

217. WINSTON, J. R.

664.85.3 : 632.4 : 546.273.33

Reducing decay in citrus fruits with borax.*Tech. Bull. U.S. Dep. Agric.* 488, 1935, pp. 32, bibl. in text.

Experimental work was started in 1931 at Orlando, Florida, to discover whether a more effective control of stem-end rot could be obtained by treating citrus fruits in the packing house with borax or some other cheap antiseptic. Various concentrations of borax and boric acid, and one solution of sodium carbonate containing the same concentration of sodium ions as is found in a 5% solution of borax were tested, together with length of immersion, temperature of solution, and time of application. The results indicate that immersion in borax immediately on arrival at the packing house is effective in retarding decay caused by stem-end rot and also by blue mould organisms, whether the fruits are fully coloured or need colouring treatment, but is less effective on over-ripe fruit ready to drop from the tree. The efficiency of the treatment is reduced by delay. The evidence indicates that it is the boron ion which exerts the principal fungicidal effect, and the efficacy of the borax solution increased until the concentration reached about 8-10%. Different lengths of immersion from a momentary dip up to 12 minutes with a 5% solution did not show significant differences in control, but there is some indication that periods above 2 minutes may give better results than shorter times. The borax residue is objectionable and should subsequently be washed off, but experiments showed that rinsing following immediately after dipping minimized the effect of the treatment, and it is therefore suggested that, where possible, the treated fruit should be dried slowly and the borax residue left on for several hours. The temperature of the solution was only found to be important in so far as borax shows low solubility in cold water. For this reason it is desirable in cold weather to raise the temperature of the rind of the fruit to about 90°F. before treatment. As the result of earlier experiments several packing houses have conducted treatment on a commercial scale, and from these it would appear that with proper organization the cost of the operation should not exceed $\frac{1}{2}$ - $\frac{3}{4}$ cents per 100 lb. fruit.

218. FAWCETT, H. S., AND OTHERS.

664.85.33 : 632.48

Effects of storage and holding conditions on *Alternaria* in lemons.*Calif. Citrogr.*, 1936, 21 : 118, 143, 144.

Sixteen each of comparable boxes of commercially packed lemons were placed in air conditioned, refrigerated storage and in naturally ventilated storage. On examination six months later those from refrigerated store (temperature 57°-52°F., mean relative humidity 90.5%, maximum CO₂ 0.14%), had shown superior keeping qualities to those from the naturally ventilated store (temperature 60°-50°F., mean relative humidity 87%, maximum CO₂ 0.28%). These superior keeping qualities were subsequently maintained when eight random samples from each set were wrapped, packed and placed in temperatures of 36°, 42°, 48°, 53°, 59°, 65°, 76°, 90°F. respectively for a period of two weeks. The relative humidity was 85% except for the cabinets at 76° and

90°, where it was 75% and 92%. The CO₂ concentration was too low to be tested with the means available. After removal from store the fruit from air conditioned, refrigerated storage continued to show less rapid breakdown than that from naturally ventilated store.

219. WARDLAW, C. W., AND LEONARD, E. R.

664.85.771 + 664.85.653 + 664.85.3 + 664.84.64 + 664.85.651

The storage and physiology of tropical fruits.*

Trop. Agriculture, Trin., 1936, 12 : 313-9.

Part I. *Storage investigations. Bananas.* Research in bananas has mainly concentrated on attempts to find a banana immune to Panama disease with which to replace the susceptible Gros Michel, the chief commercial variety. The extreme suitability in every other way of the Gros Michel makes the task of finding a successor combining all its good qualities sufficiently arduous. Thus Lacatan will not suffer the Gros Michel temperature transport of 53°F., and at 58°F., the temperature it requires, fungal infection is accelerated. It is also more liable to mechanical injury. The tougher skinned Giant Governor also chills at 53°F. and has to be allowed to reach the stage of "heavy fulness" before harvesting, otherwise loss of appearance and flavour results. The Cavendish banana, cultivated in the Canary Isles, though resembling Gros Michel in its general behaviour, has a spreading bunch and is susceptible to bruising and storage troubles. However, I.C.2., a cross between a wild variety and Gros Michel, originated at the Imperial College, shows immunity to Panama disease together with fine flavour and colour. The shortness of individual fruits can be minimized by cultural measures. *Tomatoes.* Here fruit picked full grown but green has been found to keep in cold storage (40°-47°F.) for 20-30 days and to remain in good condition after removal from store for a further 8-10 days. In England experiments at the Low Temperature Research Station, Cambridge, have shown that summer grown glasshouse tomatoes in England gave correspondingly good results, but that autumn grown fruit showed much reduced keeping qualities. *Avocado.* Only fruit from seedling trees is available at present and observations based on fruit from some 50 trees of seedling origin showed an extreme variability to exist, not only in physical appearance but also in storage behaviour. The problem appears to be one of selecting varieties possessing suitable commercial qualities combined with adequate cold resistance. *Limes.* The maintenance of a high humidity in storage is necessary to prevent shrivelling and much damage may be done even while the fruit is waiting to be graded and packed. Speedy handling, the protection of the fruit by suitable wrappers and a rapid cooling to 45°F. are essential. Certain hybrids immune to wither-tip disease have been recently evolved and of these T.I., owning the Philippine lime as a parent and having a fruit of good appearance, juice and oil content, is being grown and marketed. *Grapefruit.* Particular attention has been paid to storage temperature for short or long periods, chilling, desiccation, and wastage. The behaviour of fruit from trees attacked by gummosis and root rots is being studied. In all these studies the relation between environment and keeping qualities varies with the locality, so that results obtained in the storage of tropical fruit in other countries may by no means hold good for Trinidad (even grapefruits from different parts of Trinidad show differences in keeping quality and disease resistance in store).

Part II. *Respiration in developing, maturing and senescent fruit. Relation between external surface and respiration.* In these studies the fruit of the papaw was mainly used, since its large internal cavity of 900-1,200 cc. renders it especially favourable for investigation. As a result data are now available which can provide a coherent account of internal gas relations throughout the life of the fruit. A graph is given summarizing the relationship throughout the life of a papaw fruit of the internal carbon dioxide concentration and respiration as usually measured. The internal CO₂ curve and the rate of respiration curve run closely parallel. High internal values characterize the smaller fruits and low values the fruit prior to the climacteric of maturity. *Respiration during ripening and senescence.* Internal carbon dioxide concentration increases while the external liberation is falling, thus it is evident that the processes involved in the colouring or softening of the fruit are concerned in an increased resistance to the movement of gases. Contrary to what is possible with other fruits the recording of internal gas concentrations

* Paper communicated to the Imperial Botanical Conference, London, August 1935.

could be continued until the fruit had reached an advanced stage of decay. The increased rate of respiration which accompanies the stage of decay when fungal growths are active has usually been attributed to the active metabolism of the fungi. The authors take the view that this increased leakage is in reality largely due to the high internal carbon dioxide concentrations penetrating ever more easily through the partly destroyed epidermis. The increase in internal carbon dioxide is marked by a corresponding decrease in internal oxygen concentration. In the initial stages the sum of the percentages of the two gases is 21%. *Transition to anaerobic respiration.* Finally, as fungal activity spreads, the percentage of internal oxygen diminishes to zero, while, especially in the presence of yeasts, the CO_2 value may increase up to as much as 60%. Thus the later stages of ripening are characterized by a transition from aerobic to anaerobic respiration and the authors consider that an investigation of the extent to which the several aspects of loss in resistance to fungal attack are referable to decreased oxygen or to the depressant action of high concentrations of carbon dioxide is a line of investigation well worth following up. *Initiation of ripening.* It is shown that the completion of the process of seed formation acts as the directive stimulus in the initiation of ripening, that change of colour of the flesh does not occur until then, and that it proceeds from the seed outwards along the main vascular strands. This holds good with other species examined. *Application to gas storage.* Data have been accumulated which afford a more precise understanding of the actual conditions prevailing within the fruit under various gas storage conditions. The rate at which carbon dioxide will be liberated superficially is influenced profoundly by the actual internal concentrations of carbon dioxide, oxygen and nitrogen gases together with the gradients of gaseous concentration created in conjunction with the external atmosphere provided. Many of the high rates of respiration recorded when fruits are transferred from one gaseous medium to another are merely readjustments to the several gaseous concentrations and are not connected with the actual state of metabolism at that point.

220. WARDLAW, C. W., AND LEONARD, E. R.

664.85.441

Storage of West Indian mangoes.

Mem. Low Temperature Res. Sta. Trin. 3, 1936, pp. 47, bibl. 23, obtainable
Editor, *Tropical Agriculture*, Trinidad, 2s.

The increase in acreage of grafted mangoes has made it necessary to find fresh outlets for the disposal of this fruit. The outlook for markets abroad is promising once the storage difficulties in connexion with this delicate fruit have been overcome. In this instance fruit picked somewhat immature will have to survive 10-20 days transport plus a further distribution period of 5-10 days. The three varieties to which the investigators have devoted particular attention are Julie, a free bearer under Trinidad and St. Lucia conditions, Peters or Bombay, the best export type from Jamaica, and Ceylon No. 1, the best in Grenada or Dominica. Many other varieties have been examined as a means of testing the range of physiological behaviour exemplified by the mango. The experiments, as a result of which the following (summarized) conclusions are made, are explained in detail. With cold storage facilities available from the day of picking, best flavour and minimum wastage were obtained with Julie, picked just prior to softening and stored at a temperature of 45°F. Fruit undergoing longer journeys, 15-20 days and, therefore, picked less mature suffers from chilling at this temperature. For this class a temperature of 48° with delivery air not falling below this is recommended. A storage temperature of 50°F. for 15-20 days is high enough to allow storage pathogens to multiply, resulting in severe wastage besides being disadvantageous in other ways. Ripening after removal from store should occur in 4-7 days at 65°-70°. There is no doubt that a swifter moving overseas transport would allow good class fruit to be shipped at 50°-60°F. Wastage due to infections latent at the time of picking is greatly increased by chilling, prolonged cold storage, slow ripening and delay in distribution. Careful orchard sanitation may in some degree reduce this, but in any case the wastage will always probably exceed the 10% allowed to other fruits. Packing should be at present in standard tomato lugs 5" × 16½" × 17", in two layers, the fruits being each wrapped in a moisture-retaining paper and padded, where they touch the wood, with a minimum of woodwool compatible with efficient protection.

PACKING, PROCESSING, FRUIT PRODUCTS.

221. GREGORY, J. H.

634.771-1.564

Packing bananas for market.*Qd. agric. J.*, 1935, 44 : 468-84, 601-21, and 750-9.

The harvesting, handling, and packing of Cavendish bananas in Queensland for despatch to Australian markets apparently leaves much room for improvement. This paper sets out instructions for growers in great detail, supplemented by numerous photographs and diagrams. The adoption of a 1-bushel case in place of the commonly-used 1½-bushel case is advocated. After describing right and wrong methods of preparing the fruit for packing, and the way in which the boxes should be constructed, a description is given of four grade standards. These are based entirely upon size, and the fruit in all cases must be sound. Bananas picked during hot weather should be sweated for about 24 hours, during cool weather for longer periods. The market prefers bananas packed as singles, but as this system would increase the grower's work three-fold and also increase the risk of damage and infection from disease, it is unlikely to be adopted as the only method. Descriptions are therefore given of the ways in which singles, pairs or twos, part-hands, and full-hands should be packed. Nailing down is assisted by using a lidding press. Wiring the boxes at either end is advocated. The salient points in banana packing are summarized as follows :—(1) Care in harvesting from the stool and carting to the packing house to avoid damaging the fruit. (2) Care whilst removing the hands from the bunch, and whilst breaking the hands into part-hands or singles to avoid wrenching the shanks. (3) Keeping the fruit cool in summer, and preventing chilling in winter. (4) Packing fruit over rather than under size. (5) Packing the cases to a natural bulge. (6) Not packing diseased or malformed fruit. (7) After the despatch of each consignment cleaning out the packing shed and implements. Spraying the shed occasionally with a 1 in 20 solution of formalin in water to minimize fungal infection is advocated.

222. ADAM, W. B.

664.85

Varieties and quality of fruits required for canning.*Cherries and soft fruits : varieties and cultivation in 1935*, 1935, pp. 148-56, bibl. 2, Roy. hort. Soc., London, 6s.

Fruits in general should be firm-ripe and fully coloured on arrival at the canning factory. Exceptions are gooseberries, which are green and hard when canned, and blackberries, which should be fully ripe. Evenness of maturity and freedom from malformation, from spray residues, and from blemishes caused by insects or diseases are important. The pests and diseases most likely to cause trouble are mentioned. Among the latter the heat resistant mould *Byssochlamys fulva*, which has caused serious damage in a small proportion of packs (after processing), is noted. The ascospores of the mould have been found widely distributed in orchards and plantations, but there is no indication of the fungus attacking the plant in the field, and further information is required before any suggestions for control can be made. Rapid transport between orchard and factory is desirable. Experiments made in 1934 with railway refrigerator vans cooled with "dry-ice" showed that the radius for the transportation of strawberries could be increased considerably by this means. In the case of strawberries and Victoria plums fruit of excessive size is sometimes included, but in the main it is undersized fruit of all types which canners are anxious to avoid. A high ratio of stone to flesh in plums and cherries may make some varieties unsuitable. In general, therefore, the qualities desired may be divided into two groups—those affecting appearance, such as colour, shape, firmness and freedom from blemishes or malformations, and those affecting edible properties such as flavour, texture and size of stone. Investigations on the suitability of different varieties for canning have been in progress at the Campden Research Station for the past eight to ten years. The results of this work are summarized here for the following fruits—apples, blackberries, black currants, cherries, damsons, dewberries, gooseberries, loganberries, plums, raspberries, red currants, and strawberries. A list of varieties approved under the National Mark scheme is appended.

223. BLUMENTHAL, S. 664.85.23

Experiments on hardening of soft cherries in brine.

Fruit Prod. J., 1935, 15 : 46-7.

Experiments were made with several chemicals to determine a method of hardening cherries, which sometimes become soft while in brine, following bleaching with sulphur dioxide gas or sulphurous acid solution. In all cases the cherries remained firm while in a sulphurous acid brine, but after washing the acid out there was a tendency for them to soften. When the sulphur dioxide content had been reduced to about 800-1,000 p.p.m. the standard amount of colouring dye was added, and together with this in one case 8 oz. calcium chloride, and in another 4 oz. alum were added per barrel. These chemicals produced a noticeable improvement in hardening of the fruit, and were almost entirely removed during subsequent processing.

224. McCUTCHEON, W. 664.85.21.047 + 664.85.25.047

Drying apricots and peaches.

Agric. Gaz. N.S.W., 1935, 46 : 700-3.

The stage of maturity is important in determining the quality of dried apricots, and pickings should be frequent to avoid the inclusion of unripe or overripe fruits. Varieties like Moorpark, which tend to ripen one side of the fruit before the other, are best picked when the riper parts are fully mature, and then left in the picking tins overnight before processing. In pitting, the largest single item in the cost of drying, the fruit should be cut right round, opened out, and the stone removed. In drying the pitted fruit is placed cut surface uppermost on wooden trays. For sun drying two useful sizes are trays 4' x 3' and 6' x 3'. If an evaporator is used, the size of the tray will depend upon the design of the chamber. It has been observed that the best samples are usually produced when about two-thirds of the drying is done in the sun, and the remainder in shade in the stack. The fruit must at all times be protected from rain and dust. Where the fruit is overdried, sprinkling with water is liable to have disastrous results. Actually the weight differences between "dry" and "overdry" fruit is normally only about 2-3%. Following drying the fruit is exposed in a chamber in which sulphur is burnt. Sulphur dioxide is absorbed, acting as a preservative, and fixing the colour. The process is described. The length of exposure depends mainly on the temperature of the day, and ranges between 3½-4 hours for shade temperatures of over 100°F. to 8 hours for temperatures under 70°F. The sulphur to be effective should burn during the whole or almost the whole of this period. If the skin readily slips from the pulp between the thumb and forefinger, the process is complete. The legal tolerance is 14 grains SO₂ per lb. dried fruit. Peaches are dried in the same manner, but require from 50-75% longer exposure to the sulphur fumes. The drying of peeled peaches on the orchard site is still in the experimental stage, but seems to offer possibilities.

225. THOMAS, P. H. 663.813

Fruit juices.

Tasm. J. Agric., 1935, 6 (n.s.) : 160-1.

A brief account is given of the manufacture of fruit juices, including preparation of the fruit, clarification, and pasteurization. The fruits most in favour for this purpose are loganberries, raspberries, black currants, and tomatoes, but other fruits which may be processed and are in demand include mulberries, strawberries, red currants, passion fruit and blackberries. An apple juice with a low alcoholic content may be produced in a similar manner.

226. STEUART, D. W. 663.3

Cyder.

J. Soc. chem. Ind., Lond., 1935, 54 : 879-81.

The manufacture of cider and the chemical changes involved are outlined. As an example of the great differences existing between apple juices used for this purpose, the compositions of an average sample of French cider apple juice and of a sample of English juice from the Eastern counties are given. Methods of manufacture adapted to these types are discussed. A brief account is also given of the processes of pasteurization and fermentation, and the nutritional value of cider, and mention is made of the by-products, "lies" and pressed pomace.

227. TUCKER, D. A. 663.813
Experiments on the canning of apple juice.
Fruit Products J., 1935, 15 : 7-8.

It is thought that canned apple juice providing a form of sweet cider would become a popular beverage, if means were found to eliminate corrosion and the resulting hydrogen swelling and perforation of the cans. The results of several attempts to obtain data on this subject are outlined, and these, together with experience based on the canning of orange juice, form the base of the following suggestions as to procedure. The steps are:—1. The fruit should be washed in acid solution to remove lead and arsenical spray residues. 2. It should be crushed, pressed, and filtered to remove suspended matter. 3. The juice should be put in a vacuum tank, preferably glass lined or of stainless steel, and a vacuum of 28-9 inches applied for about 20 minutes to remove dissolved and occluded oxygen. 4. The juice should be flash pasteurized for 30-60 seconds at 185°F., poured immediately into the cans to within about $\frac{1}{4}$ inch of the top, sealed at once, and cooled rapidly in cold water, or alternatively, the cans may be filled leaving a good head space and then exhausted in water at 150°F. for about 10 minutes. In the case of small cans processing at 150°F. should continue for 30 minutes.

228. FINDLAY, G. H., AND SNELL, J. F. 633.64 : 581.192
Some constituents of the sap of the sugar maple (*Acer saccharum*, Marsh).
Canad. J. Res., 1935, 13 : 269-75, bibl. 15.

Skazin's observation that maple flavour is not present as such in sugar maple sap but develops at boiling temperatures (100-104°C.) has been confirmed. Levorotatory glucosides cannot be detected in sap concentrated to 1/150th its volume, and are therefore probably not present in amounts exceeding 1 gm. (calculated as coniferin) per 50 litres. In maple wood, pyrocatechol tannins were detected but no alcohol-soluble glucosides. The sap contains succinic acid, a glucosidase, an unsaponifiable oil, a water-soluble substance melting at 191.5°C.,* and having the composition $C_{11}H_{21}O_9$, and an acetone-soluble substance giving lignin-like colour tests. Maple flavour could not be developed in any individual constituent of the sap. [Authors' summary.]

229. THOMPSON, W. S., AND PETERSON, W. H. 664.84.65
Chemical composition of canned peas of two varieties of different sizes and grades.
J. agric. Res., 1935, 51 : 365-70, bibl. 9.

Samples of two important varieties of peas, the Alaska or smooth and the sweet or wrinkled, were analysed with particular reference to mineral contents, but data concerning fibre, protein, and dry matter contents are also presented. On a wet basis the percentages of all constituents, except copper in the Alaska variety, increase in general with the size of the canned pea. On a dry basis, however, the percentages of these constituents remain practically constant, showing that mineral elements and total solids are laid down at approximately the same rate. The Alaska variety contained more protein, calcium, and phosphorus than the sweet or wrinkled type, a fact which from some points of view indicates superior nutritive value.

230. MITCHELL, J. S. 663.813 : 635.64
Comparative composition and color of commercial tomato juice.
J. Ass. off. agric. Chem. Wash., 1935, 18 : 128-35, bibl. in text.

Juice samples, mainly from the 1932 tomato pack, and taken from different canneries in the U.S.A., were analysed to determine total solids, soluble solids, salt content, total acid, refractive index, and colour. In estimating colour, use was made of the scheme of notation suggested by

* All melting points are corrected.

MacGillivray, by which the chroma number is subtracted from 13, and this result added to the true number. Results are tabulated in full and show that a fairly wide variation exists among brands of tomato juice in respect of all the constituents. Flavour and colour were found to be inferior in samples packed late in the season. From the data obtained on the refractive index a formula has been evolved by which the total soluble solids may be calculated with a fair degree of accuracy. Finally pH values of a series of samples were determined by five methods, all of which showed reasonably good agreement in results.

231. KNAPP, A. W., AND COWARD, K. H. 577.16 : 633.74
The vitamin D activity of cacao shell. I. The effect of the fermenting and drying of cacao on the vitamin D potency of cacao shell. II. The origin of vitamin D in cacao shell.
Biochem. J., 1935, **29** : 2728-35, bibl. 22.

1. It is improbable that either vitamin D or ergosterol is present in the fresh shell of the cacao bean. 2. During fermentation yeast containing ergosterol develops in the pulp on the shell. 3. During drying in the tropical sun the ergosterol is converted into vitamin D. 4. Hence the order of vitamin D potency of the shell of the cacao bean is : (1) artificially dried—absent ; (2) not deliberately fermented but slightly fermented during sun-drying—fairly high, approaching the potency of dairy butter ; (3) fermented and sun-dried—very high, twenty or thirty times the potency of dairy butter. [Authors' summary.]

232. WILLIAMS, W. H. 634.62-1.57
Date products. [Report summarized by H.B.C.]
Food Manuf., 1935, **10** : 352-4.

The utilization of surplus dates and improvements in the packing and storing of dates have been the subject of experiments conducted in Baghdad. A preliminary report here summarized provides information on the following products which may be prepared from dates :—date syrup, vinegar, cattle foods, date powder, date pulp, alcohol from dates, date stone products, and canned dates. In packing, the long fancy cartons used in Tunisia and Algeria might be substituted for the less attractive local packs with financial advantage. Storage methods require improvement, but little information is at present available. In conclusion the preliminary nature of the work is stressed. It has been shown that several attractive by-products can be prepared, but it remains to be seen whether they can be developed on a commercial basis.

233. CLEVENGER, J. F. 668.52 : 633.834
Volatile oils in mace and nutmegs.
J. Ass. off. agric. Chem. Wash., 1935, **18** : 611-6.

Representative results are tabulated of determinations made during the past five years on the volatile oils obtained from importations of mace and nutmegs. Two sources of origin, the West and East Indies, provide characteristic products in each case, and the East Indian imports may be further divided into three general groups, Banda, Padang, and Papua mace and nutmegs. The volatile oil from West Indian mace and nutmegs may be recognized by its low specific gravity and refractive index, and its high optical rotation. Volatile oil from nutmegs has a greater positive rotation than that distilled from the corresponding mace, but this may be due to a loss of the more volatile fractions of oil from the mace. Shrivelled, immature, but sound East India nutmegs give a larger percentage of volatile oil than do mature, sound ones. Grinding some uniformly mixed Papua mace and West India nutmegs produced relatively rapid loss of volatile oil amounting to about 80% in two months. The remaining oil showed a definite increase in the specific gravity, refractive index, acid and ester number, and a distinct decrease in the optical rotation. These results should prove valuable in determining the conditions under which these products are handled. Finally, the characteristics of the volatile oil should be useful in identifying unknown samples of mace and nutmegs.

NOTES ON BOOKS AND REPORTS.

234. NOMBLOT, A. 634.1/8
Traité d'arboriculture fruitière et de pomologie. (Manual of fruit growing and pomology.)

Librairie Agricole et Horticole de la Maison Rustique, 26 rue Jacob, Paris, undated, pp. 383, 12 francs.

This fruit growing manual is divided into three parts. Part I deals in a general way with the whole process of hardy fruit culture from choice of site to picking, storing and marketing of the fruit. Part II deals with each kind of fruit in turn and thus covers much of the same ground as Part I. Part III consists of lists of the different varieties of hardy fruits with brief descriptions of each. There is much practical information in the book, in particular methods of shaping fruit trees into artificial forms such as pyramids and fuseaux being carefully described and copiously illustrated. There is, however, no attempt to describe the findings of modern scientific research investigations into the fundamentals of fruit production, and such allusions as are made to such matters as manuring, rootstock selection and spraying appear to be based on empirical rather than on experimental evidence. N.B.B.

235. MARKHAM, E. 634.711 + 634.714/5
Raspberries and kindred fruits.
Macmillan, London, 1936, pp. 68, 6s.

A thorough up-to-date textbook on small fruit growing in England would be most acceptable. This small volume on raspberries, blackberries and logans is well printed and illustrated, but the author does not appear to have noted some of the more recent English work on the subject.

236. HORTICULTURAL EDUCATION ASSOCIATION. 634/5(058)
Scientific Horticulture, 1936, Vol. 4, pp. 218, R. T. Pearl, Editor, S.E.
Agric. Coll., Wye, Kent, 3s. 6d. plus 5d. postage.

Twice recently in attempting to answer enquiries from overseas on points about which little has been published the writer of this review has run to ground the relevant information in previous numbers of this year book. The present number does not fall short of its predecessors. Regional horticulture is discussed in articles on commercial horticulture in Sussex, on growing market garden crops, potatoes, tomatoes and raspberries in Scotland, and on flower culture in the north of England. Interesting articles appear on dwarf pyramid apple culture at Cannington and on fruit requirements for the cider industry, about which many people seem to possess vague notions, but few any definite information. One welcomes the accounts of the activities of two research stations, namely of the Lea Valley Glasshouse Industry at Cheshunt and the St. Ives Research Station, Bingley, Yorks, run by the Board of Green-keeping Research. Eminently practical articles deal with the use of small cultivator machines in horticulture and with the growth of seedlings in partially sterilized soil, while most interesting notes are made on the methods of vegetative propagation used in Stewart's experiments at the Royal Botanic Gardens, Edinburgh. Pathology is represented by two articles on the *Phytophthora* disease of the strawberry and by a concise account of virus diseases of glasshouse and decorative plants. Short, clear accounts are given by experts of three subjects, about which in recent years there has been a good deal of talk but little clear information, namely vernalization (for hastening flowering), effect of length of day on flowering and gas storage.

237. MACMILLAN, H. F. 633/634 + 635.952.2
Tropical gardening and planting.
Macmillan & Co. Ltd., London, 1935, 4th Ed., pp. 560, price 25s.

This book has for many years been regarded as the bible of amateur gardeners residing in the tropics. Its popularity is such that in spite of succeeding editions it is usually out of print and, being the kind of book to which its owner clings to the last, second-hand copies have always been

hard to come by. The recent appearance of the fourth edition, enlarged and brought up to date, is therefore very welcome and we advise those interested to acquire their copies early. The first section of the book deals generally with climates and soils, plant reproduction, nutrition, etc., and then becoming practical, concludes with a series of chapters in which every garden operation from propagation to garden design is described. The descriptions are necessarily short but little seems to have been omitted, for the author has the art of writing with conciseness and clarity to a marked degree. Section 2 gives selections of plants for various situations and purposes with annotated lists in which plants are grouped under various headings such as palms, ferns, shade trees, annuals, etc., and even, so carefully has the author catered for every human gardening whim, "pot plants for up-country" and "plants for railway banks". An index facilitates reference. This is one of the most interesting sections, the number of plants which receive mention being truly immense. Section 3 is concerned with fruits and vegetables both tropical and sub-tropical. Section 4 deals with estate products of every kind, i.e. drugs, oils, rubber, gums, fibres, dyes, tans and pastures. Section 5, pests and diseases, transport and packing of plants and seeds. Included in this section are "useful references" which should provide the diligent student with a number of accomplishments, from catching flies to laying out a tennis court. There are a few interesting recipes for jams and preserves involving the use of tropical fruits. It would be difficult to estimate the amount of information which has been packed into this book. That which we have been able to indicate represents less than the barest outline.

238. MINISTRY OF AGRICULTURE.

633.8

Herbs.*Bull. Minist. Agric. Lond.*, 76, 1936, pp. 61, bibl. 14, 1s.

This bulletin has been issued in response to the numerous inquiries as to the methods and possibilities of commercial herb growing which have been addressed to the Ministry of Agriculture. Hitherto the only official literature since the war has consisted of leaflets on peppermint and lavender. In dealing with the uses and methods of growing the various herbs the bulletin is most instructive, and the Introduction, which takes the form of a neat little sketch of the different phases of herb growing from early to modern times, is not only entertaining but possesses a literary flavour both welcome and unexpected. In dealing with the commercial possibilities it cannot be said that the publication errs on the side of optimism. Apparently scope for profitable expansion is strictly limited, the reasons being the limited and ever diminishing demand for the higher priced (and superior) English grown products, owing to cheap foreign importations, and the fact that many of the derivatives can be produced synthetically, not only more cheaply but also more accurately. The book is divided into chapters on culinary herbs, herbs used in perfumery and confectionery and medicinal herbs and contains a wealth of out of the way information that adds greatly to its interest. Fifty-seven varieties of herb receive mention.

239. SAMPSON, H. C.

635.952.2

**Cultivated crop plants of the British Empire and the Anglo-Egyptian Sudan.
(Tropical and sub-tropical.)***Kew Bull.*, 1936, additional series 12, pp. 251 + viii, bibl. in text, 6s. 6d.

This publication has been compiled in order to furnish information on the distribution of tropical and sub-tropical crop plants in the British Empire and the Anglo-Egyptian Sudan. It is hoped that the work may be of use to the officers of Departments of Agriculture and may also stimulate the trial of new crops or other varieties of crops already grown. The suggestion of the need of such a publication was first put forward at the Conference of Colonial Directors of Agriculture held in 1931 and the information contained is based on the replies to a questionnaire issued by the Director of the Royal Botanic Gardens, Kew. The plan of the book is as follows. In the portion devoted to the inventory (180 pp.) the plants are conveniently arranged alphabetically under their genera which have in turn been arranged alphabetically in the text. There is thus no need of an index. Following the specific name and the authority the presumed country of

origin is given. Then the common name of the plant is given and, following a semi-colon, any vernacular names, with their country or language shown in brackets. It is pointed out that the study of vernacular names may often give an indication of the country from which the plant has been introduced, for instance most of the Indian vernacular names for maize indicate that it came from the West, the name being derived from the place-name Mecca. A note on the nature and uses of the plant is provided in many instances. Then follows a classified list of countries in which the crop is or has been grown. The classification consists of five classes each distinguished by a letter—(a) countries in which the plant is indigenous or an early introduction, (b) successfully introduced, (c) still under trial or established on an acclimatization station, (d) introduced, but the cultivation has subsequently disappeared or has been abandoned, (e) introduced, but has failed to become established. For convenience these headings are reprinted at the foot of each double page. The book is in fact a model of convenience, though not everyone will agree with the compiler's suggestion that the printing here of all botanical specific names, no matter how derived, with a small initial letter, is also a convenience—except possibly to the compiler. Perhaps that is what he meant! At the conclusion of the inventory are 48 pages of crop notes in which a number of the staple food crops of the tropics and subtropics are very thoroughly discussed, a short bibliography accompanying each note. At the end of the book is an index to commonly-used synonyms. The publication should prove a valuable asset to all engaged in agricultural administration or research throughout the warmer regions of the Empire.

240. STOCKDALE, F. A.

634.1/8

Report on his visit to Palestine and Trans-Jordan 1935.

Publ. Colonial advisory Council of Agriculture and Animal health, 247, 1935, pp. 86.

The author visited Palestine in the spring of 1935 at the request of the High Commissioner, and the present report deals very fully with the many aspects of the agriculture of that country, containing much useful information on present conditions and many suggestions for improvements in the future. Among general recommendations the need for securing additional and improving available water supplies, and the necessity of paying greater attention to the control of soil erosion are stressed. These should be borne in mind particularly in connexion with accelerated afforestation. The present provision of windbreaks for fruit trees is also often inadequate. As regards the rapidly expanding citrus industry (the estimated crop for 1935-6 is 8½-9 million cases, for 1939-40, 17-18 million) difficulties may be expected in the near future, unless markets expand, the marketing season for fresh fruit be extended by means possibly of gas storage, and unless the by-products development becomes adequate to absorb culls and low grade fruit, thus making a place for higher grade fruit on the local market. In this connexion attention will have to be paid to the canning of grapefruit, and the conversion of low grade oranges and grapefruit into by-products, together with the organization of the local market. Restriction by Government of further planting is not recommended, as this is principally a matter for the industry itself. The establishment of a central control agency is also not thought to be feasible at present, but co-operative marketing, which is making progress, should be encouraged. Further attention will have to be paid to shipping and local transport facilities, to promoting a still closer measure of supervision by the Fruit Inspection Service, and to studying means of reducing costs of production so as to counterbalance falling prices. Further information is required regarding stocks and their individual tolerances to varying degrees of salinity in irrigation water, distances of planting, and the conversion of farm and town refuse into organic manures. Finally efforts should be made to reduce still further the number of sizes of citrus cases, and, if possible, to evolve a single standard case. As regards deciduous tree fruits the deciding factor in limiting present local supplies is the *Capnodis* boring beetle, and attempts to find resistant stocks should be made. Table grapes and high quality drying grapes should be studied with a view to growing these as well as wine grapes. Considerable reorganization is required by the olive industry. Methods of picking and of oil production should be improved, and further planting of table olives seems to be justified.

241. I.N.E.A.C.* 581.08
Rapport annuel pour l'exercice 1934. (**Annual report on experimental work in 1934.**)
Bull. agric. Congo belge, 1935, 26 : 267-321.

This is the first report of the newly formed Institut National pour l'Étude Agronomique du Congo Belge (I.N.E.A.C.). The Institute takes over the pre-existing organization, la Régie des Plantations, and will endeavour to expand and improve on the work of this body particularly on the scientific and experimental side. At the outset Dr. Cramer was called in as temporary adviser, and the research programme proposed is largely based on his report. The programme of which the main items are tabulated in the I.N.E.A.C. report appears to be very comprehensive.

* Institut National pour l'Étude Agronomique du Congo Belge.